EPTEMBER, 1961

ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

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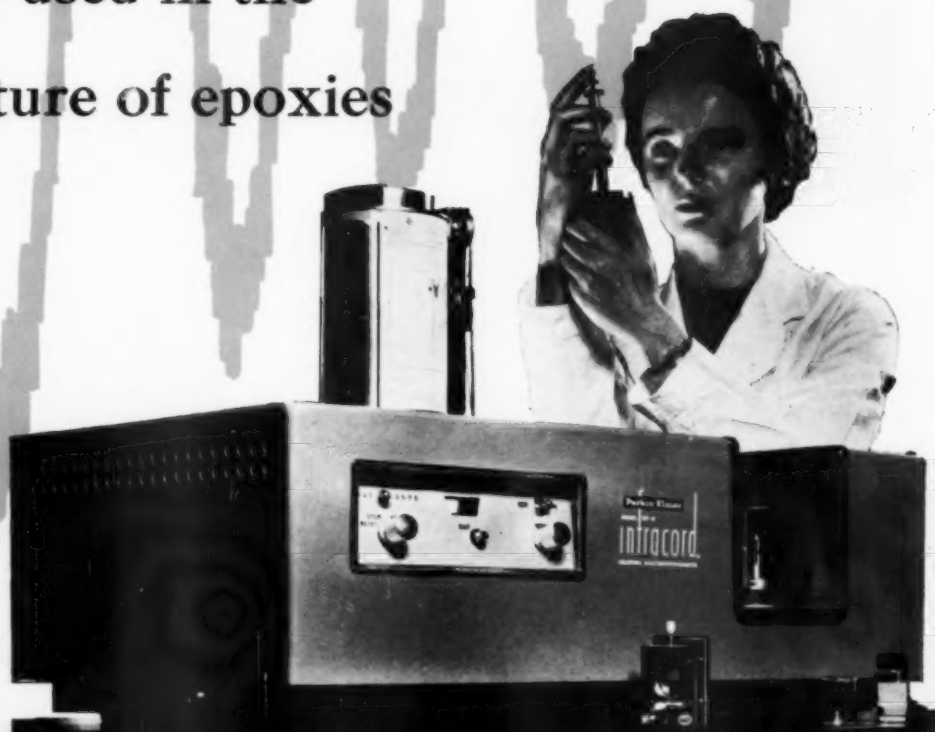
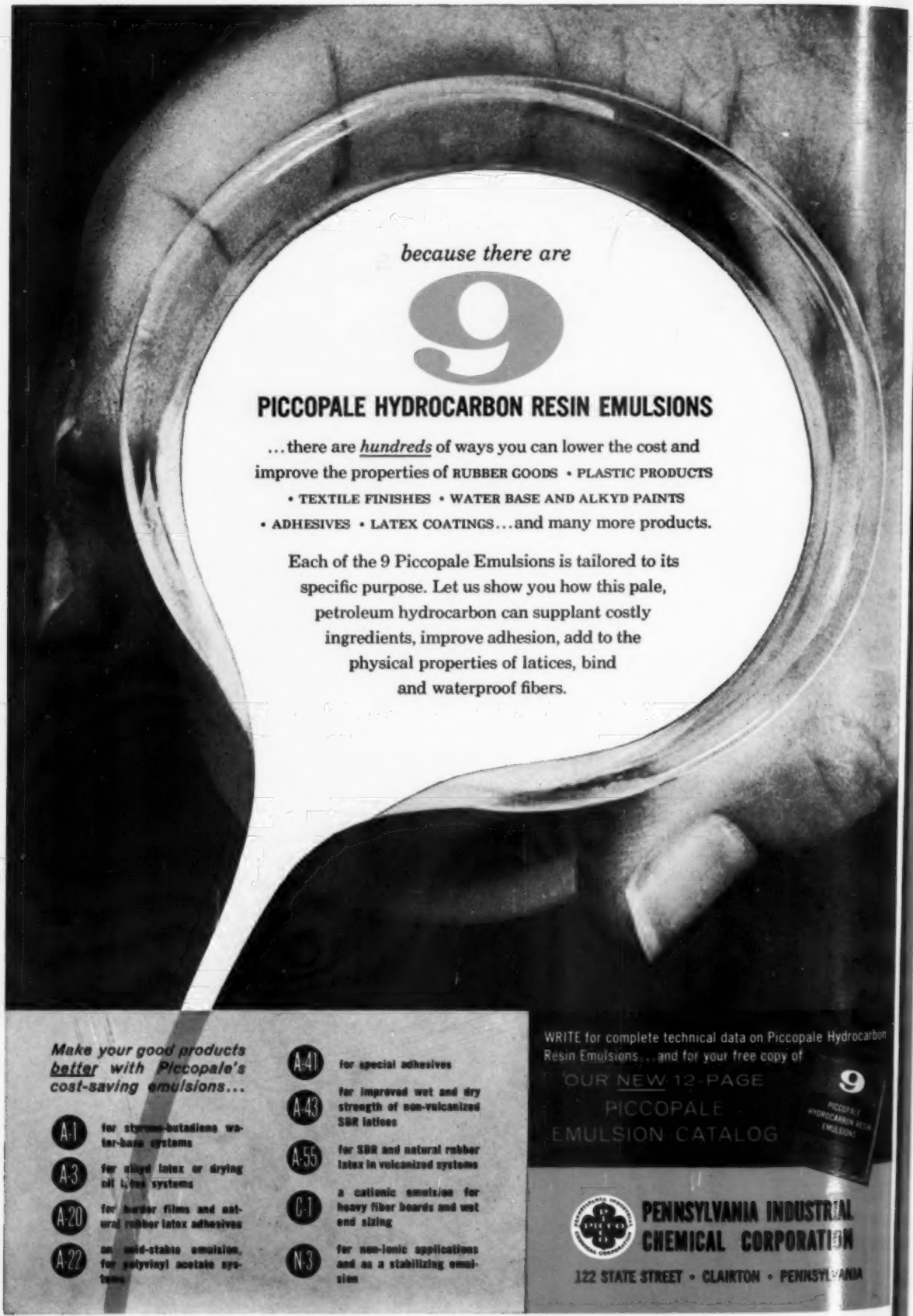
Infrared Quality Control —

how it is used in the manufacture of epoxies

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In This Issue

The Use of Infrared Quality Control in the Manufacture of Epoxy Resin Adhesives—By Henry Lee and Lois Vincent 22

This recent advance in control techniques makes it possible to do in only half an hour what would ordinarily take a month of laboratory work

Developing Special Cements to Resist Temperatures Over 4000°F.—By Kurt W. Cornely 26

Specially formulated high-temperature, refractory cement eliminates mechanical failures and the danger of interaction of the cement and component in oxidizing atmospheres

Wood Bonding Operations in Quality Furniture Production 28

Before switching to a new adhesive Bernhardt Furniture submitted test laminates to a ten-cycle soak test to see how long they would withstand delamination

Superior Strength Properties with Polymer-Modified Portland Cements—By O. Z. Tyler and R. S. Drake 30

Because they offer better adhesion to old concrete, greater dry strength, increased abrasion resistance and reduced dusting, modified cements have gained widespread acceptance during the last few years

Bonded Teflon Helps Solve a Sticky Problem 39

Sheets of Teflon bonded to the interior of molasses-feed scales help stop clogging and frequent, time-consuming cleaning operations

About the Cover Photograph

Among specialty products, adhesives are probably the most sensitive to minor shifts in the quality of raw materials. This month's cover draws attention to the article on infrared quality control beginning on page 22. A recent laboratory innovation, this technique is said to provide both more accurate and faster results. Two research chemists explain why. (Photo courtesy of the Perkin-Elmer Corp., Norwalk, Conn.)

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PALMERTON PUBLISHING COMPANY, INC.

SEPTEMBER, 1961

VOL. 4, NO. 9

Epoxy Grout Compound Bonds Pontoon Sections of Floating Bridge

A unique adhesive application is simplifying the reconstruction of the Hood Canal Bridge which spans the Duwamish River in Washington state 40

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Proposed ASTM Test Method for Structural Adhesives

During the past few years adhesive bonding has expanded into highly demanding applications previously undreamed of and testing has had to keep pace

Chemical Prebond Treatment of Metal Surfaces for Rubber-to-Metal Bonds

Of all the tricky variable inherent in rubber-to-metal bonding, none is more important than the proper preparation of the metal surface

Three Types of Industrial Formica Bonds

The nature of the ultimate application of the cemented assembly will not only determine the grade of Formica to be used, but the type of adhesive required

Packaging Adhesives and the Food Law

Now that the fuss and fury has calmed down it is possible to examine the different ways in which the industry is practically affected

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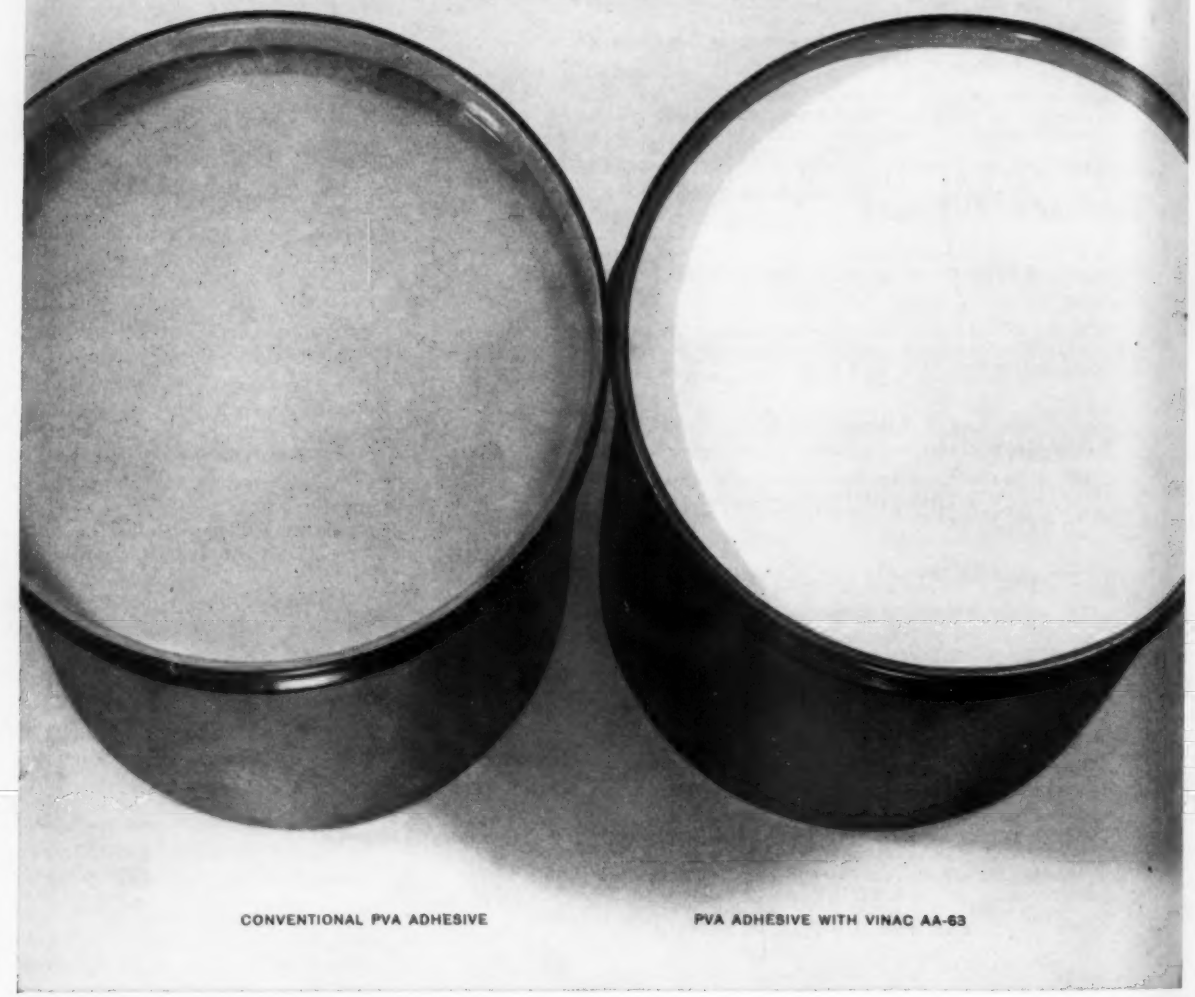

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EDITORIAL

Adhesives and Technical Service

It is, as we see it, for the editor to point not only to what is *right* with our industry but to illuminate what is *wrong*. And a wrong there is, recognized by many, and taking the form of a lack which can and should be corrected. Suppliers to the adhesives industry, both of machinery and chemicals, are doing a good job in providing technical service to the adhesives manufacturer. What kind of a job is the adhesives manufacturer doing? According to the reports we get, not too good.

Let us first establish the premise that many adhesives consumers are not technically equipped. Their primary concern is "will it stick" and "how much will it cost?" Now, many adhesives systems will provide an admirable "stick," but some are more suitable than others—some are more expensive than others—some can be stored for extended periods—some are flammable—some are easy to work with—some are difficult to work with. Dissatisfactions with adhesives are usually based upon lack of understanding. The consumer does not always understand why some particular adhesive has been recommended, what kind of job it is supposed to do, how he must apply it, and how he must handle it.

This is so because in many cases the adhesives manufacturer hasn't told him these things. The adhesives may have been sold on the basis of cost rather than performance. Or it may have been sold on performance but application information is missing.

The adhesives manufacturer may be missing the boat. Technical service—a basic technical service offering practical data—will enable the consumer to produce a better product and will enhance the reputation of the manufacturer. It seems to us that position in the industry can only be assured by a multi-stage program:

- Quality of product.
- Equitable cost.
- Adequate technical service (including lucid literature).
- Comprehensive and to-the-point advertising.

Through these means the adhesives manufacturer will reach his market—sell his products—make his fair return—and keep his business.

Your product may be good. Your package handsome. Your deliveries prompt. Your sales staff aggressive. But all this may go for nought if the vital matter of follow-up in the form of technical service is neglected.

ESTER GUMS All Types. Glycerine and pentaerythritol esters of gum, wood, polymerized wood, hydrogenated wood, dimerized wood and tall oil rosins.

PURE PHENOLIC RESINS Heat Reactive, Novolac Type, Thermoplastic and Terpene. A wide variety of resins intended primarily for tackifying and reinforcing neoprene, acrylonitrile and other synthetic elastomers.

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CHEMICALS Phthalic anhydride, maleic anhydride, pentaerythritol, formaldehyde, methanol, phenol and phenol derivatives.

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CONSULTANT'S CORNER

By Dr. Irving Skeist

Packaging a Solvent

Question: We manufacture and package plastic autobody filler. This material is catalyzed with methylethylketone peroxide packaged in a polyethylene tube. Our problem is bonding the polyethylene tube to the can in which the patching compound is packed. We have had no difficulty in finding adhesives that will bond the polyethylene, but when tubes are filled with MEKP the adhesive soon loses its strength and the tubes fall from the container.

We need an adhesive that will have enough tack to hold the tube upon contact without necessitating the use of clamping devices. The bond must be secure enough to hold the tube for normal handling and shipping. It will, of course, be necessary to peel the tube from the can before use.

Answer: Polyethylene is inert to many materials, including even one as active as methylethylketone peroxide. Also, this plastic has the toughness that is lacking in other materials that might be considered for packaging MEKP. However, polyethylene is not as impermeable as might be desired.

Try lining the polyethylene tube with saran, which can be applied by spraying. This may give you sufficient resistance to penetration of the ketone peroxide.

Q-194

Wax-Coated Leather

Question: In your May column, we noticed an item [Q-180] about sticking two waxes together. We have a problem at our plant in that we want to make a cement process shoe, and we are treating the soles with microcrystalline wax in order to make them waterproof. We need an adhesive that will bond the treated sole to leather or nylon cloth.

Answer: This problem differs from Q-180. In that case it was desired to stick two waxes together. Here the problem is to bond leather to leather, or leather to nylon *despite* the presence of microcrystalline wax.

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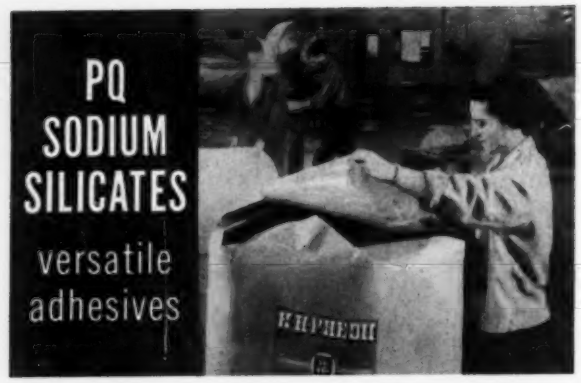

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(MEK) solvent should be effective. The ketone solvent would cut through the wax, exposing the sole. Other materials worth trying are: plasticized polyvinyl acetate emulsion containing chlorinated solvent, and a hot melt based on polyethylene.

Q-193

Applying Hot Melts

Question: We would like to have more information on the method of applying hot melts to board cartons in a pattern that covers only part of the surface. What type of machinery and materials are used?

We are not only interested in applying patterns on paper from 50 to 80 pounds, but also in applying hot melts to paper in an over-all coating—either in sheets or in a web.

Answer: The problem of applying hot melts onto cartons or paper in a predetermined pattern is not new. The question as posed, however, presents three different conditions which cannot be handled by a single applicator.

In order to deposit a hot melt adhesive onto cartons it will be necessary to custom build a unit to meet your requirements. The Potdevin Machine Co., 244 North St., Teterboro, N.J. is one of the companies experienced in this process. The product, the machinery, and the adhesive should be considered as a unit rather than as separate independent entities. It is therefore advisable to select the adhesive in conjunction with the applicator.

The coating of paper is a somewhat less specialized problem. Especially when applied to a continuous web, the hot melt can be handled by any standard coating machine. Minor modifications may be necessary to adopt the applicator to handle the various coatings and dispense the hot melt in desired patterns.

Q-198

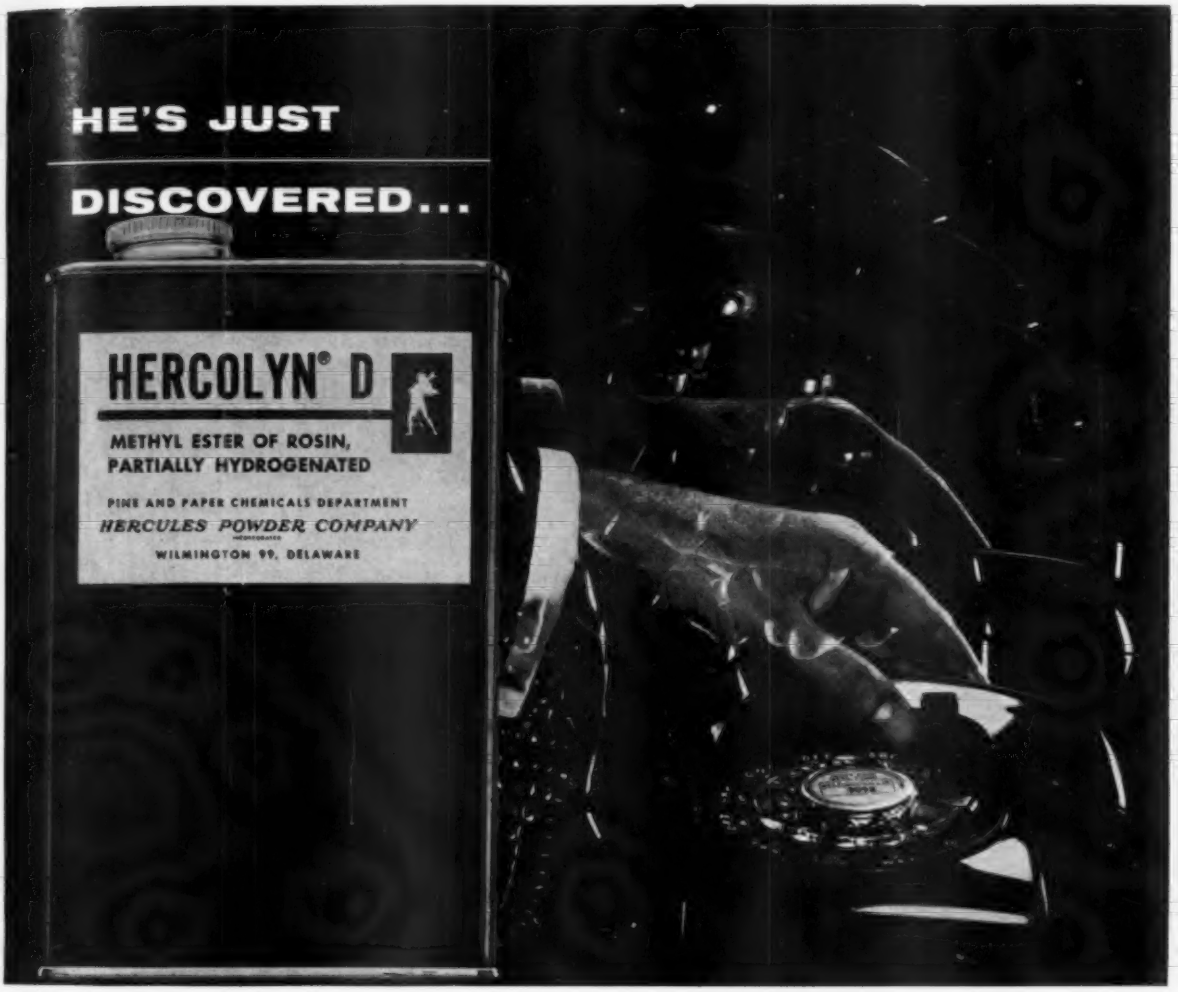
Experimental Wood Floor Tile

Question: We are seeking suppliers of adhesive for a particle board floor tile. We would like your best recommendations for suppliers of a rapid tack, water and high humidity resistant adhesive for on grade application. The mastic should have adequate flexibility, but creep resistance must be good.

Answer: Many adhesive suppliers should be able to satisfy your needs. A suitable formula might be based on reclaim rubber plus clay and a colloiding agent.

Q-197

Dr. Irving Skeist is associated with Skeist Laboratories, Inc., 89 Lincoln Park, Newark 2, N. J. He is the author of the book "Epoxy Resins."



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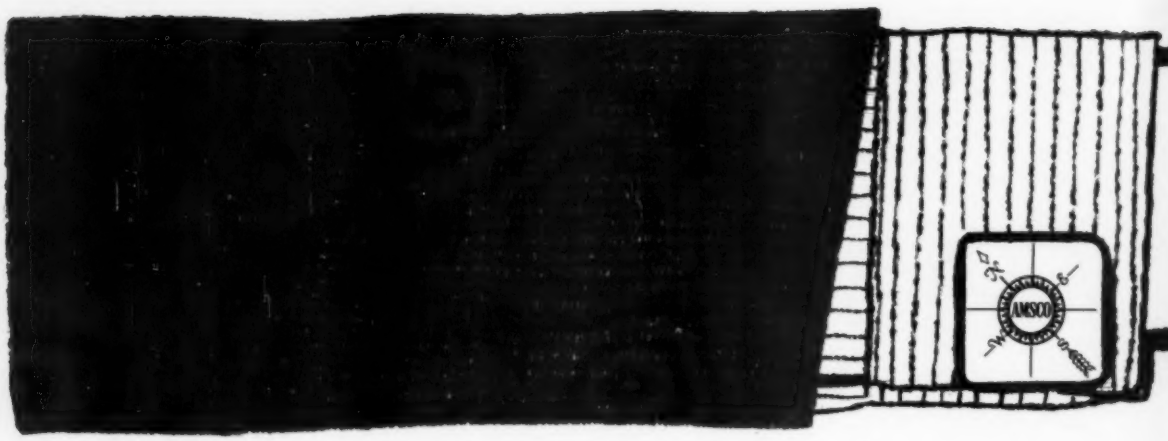
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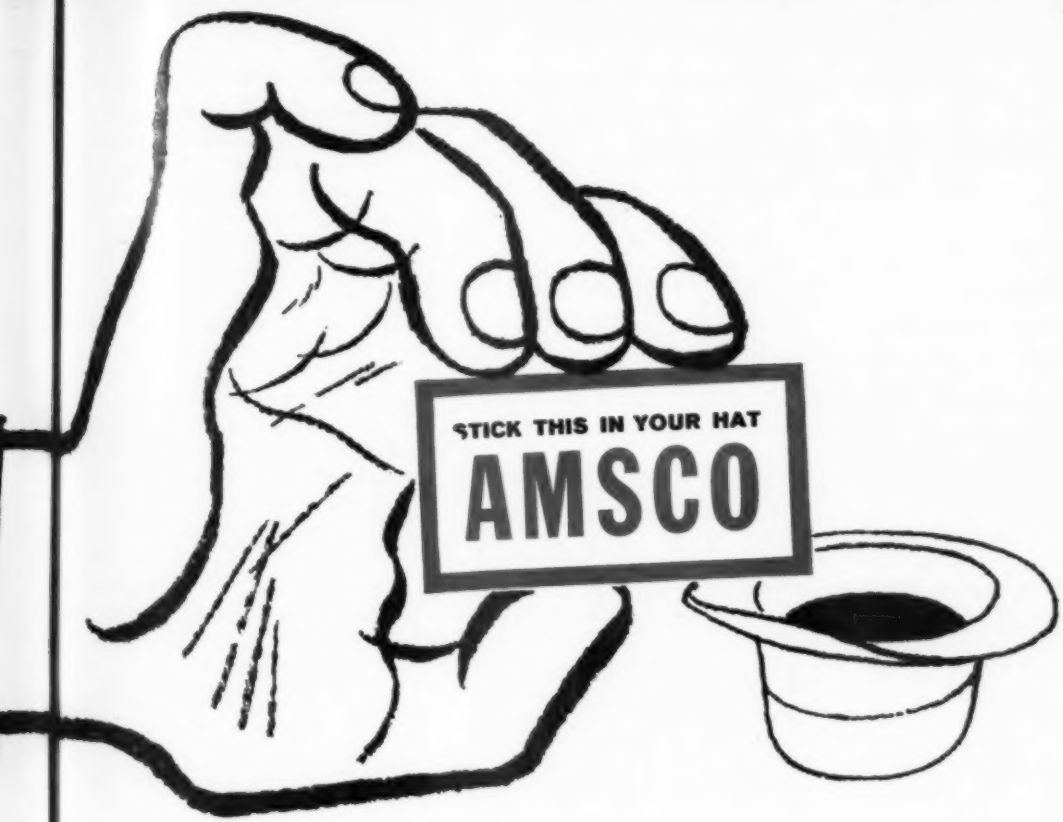

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Two new adhesives are specifically designed for use on untreated polyolefin surfaces. NPS-1 is a pressure-sensitive hot melt which can be applied from the molten state (approximately 250°F.). The adhesive sets immediately upon cooling below the melting point. Surfaces to be bonded can be coated and then joined after the adhesive has set. NPS-2 is a pressure-sensitive adhesive in a solvent system. It can be applied by brushing, roller coating, dipping or spraying. Coated surfaces must be allowed to air-dry until the adhesive does not whisker when touched. To speed the removal of the hexane solvent, a small portable radiant heater can be used. The two adhesive types can be used to bond polyolefins (polypropylene and polyethylene) to themselves, wood, metal, glass and paper. They are both said to have excellent shear strength. *Flexabar Corp.* **P-525**

Contact Cement

Modified for good heat resistance, Amer-Grip is a synthetic rubber-base contact cement supplied in grades for both spray and brush or roll application. Clear or red cement is available in either grade. Spray-type Amer-Grip should be applied in a full wet coat to each surface from a pressure-fed spray gun, using approximately 15 pounds pot pressure and a high line pressure of 80 to 120 pounds. Amer-Grip for roll or brush application may be applied with a clean paint roller, brush or notched trowel. A full wet coat should be applied to each surface. Surfaces should be allowed to dry approximately 15 minutes before bonding. Immediately after bonding, heavy uniform pressure should be applied over the entire area with a hand-roller, rubber-tip hammer or mechanical pressure rolls. *American Lacquer and Solvents Co. of Florida.* **P-526**

Epoxy-Metal Compound

Especially designed to fill, bond and repair steel, iron, aluminum, bronze, brass, lead, tiles, brick, ceramics, and most hard plastics, Elmer's All-Purpose Epoxy Metal

Compound is a two-part system consisting of a metal-filled resin and a hardener. It is resistant to most acids and alkalies, is completely waterproof and oilproof, and can be machined, filed, sanded, drilled, or tapped. It sets in two to four hours at room temperatures and cures overnight. Shrinkage is negligible when the compound is used as a filler or sealer, states the manufacturer. The compound cures to a metallic grey color. *Borden Chemical Co.* **P-527**

P-S Name Plate

Product identification and instructions can be permanently affixed with Tufmark, a pressure-sensitive name plate made of two-mil or three-mil metalized polyester film. The printing is sealed between the transparent film, the metalization and the pressure-sensitive adhesive. The labels are said to be impervious to most oils, solvents, greases, etc. They will perform at temperatures ranging from —300 °F. to 500°F. *Pee Cee Tape & Label Co.* **P-528**

P-S Business Aids

Three new pressure-sensitive tapes available are designed to meet a variety of needs in stores, plants, and warehouses. Bright yellow and black striped vinyl tapes in 1½ and three inch widths can be used for aisle marking. Red footprints or black arrows on a yellow background can be used as directional tapes to guide customers to sales areas and special displays. A "ruler that can't be misplaced" is offered for store counters, warehouses and work-benches in a pressure-sensitive measuring tape printed with scratch-proof black ink on strong transparent acetate. *Paramount Paper Products Co.* **P-529**

Glass Adhesive

Glasshesive is a high-strength epoxy adhesive formulated especially for bonding glass with a permanent transparent and shatterproof bond line. It can also be used for joining glass to concrete, masonry, metals, marble, most plastics, and similar structural materials. It keeps broken glass from shattering or separating, the manufacturer points out. Because of its low modulus of elasticity, it is flexible enough to withstand stresses caused by differential thermal expansion and contraction. Simultaneous exposure to interior heat and exterior cold will not affect the bond. *Adhesive Engineering.* **P-530**

Labeling Glue

Hot cans containing food products packed at 170° to 350°F. can be labeled right off the filling line with PX-12, a new lump form pick-up gum. One of a series of Nu-Type pick-up adhesives, PX-12 is said to offer the following advantages: lump form for easy handling, stability during operation, and clean operating at all speeds. Only a thin application is needed, and the adhesive has high tack for positive pick-up on all label stock, states the manufacturer. It is said to grab on all surfaces, even greasy tinplate. Non-staining and light in color, it handles tin, glass or fiber containers. *H. B. Fuller Co.* **P-531**

Two-Part Epoxy

Continuous peel strength in excess of 40 pounds per inch width, and initial break-away strength in excess of 100 pounds per inch width are said to be available with Tygoweld 34, a two-part epoxy adhesive. The above strengths were obtained without sacrifice of tensile shear properties that are in the 3000 psi range. Tests were made on aluminum-to-aluminum bonds using a simple cleaning process in place of chemical etching. The adhesive cures at ambient temperatures through heat may be used for acceleration purposes. *U.S. Stoneware Co.* **P-532**

Synthetic Polymer

Developed for use in electrical and electronic components, P-168 is a low conductivity adhesive based on a synthetic polymer. Chloride ion concentration is said to have been reduced from a normal 25 parts per million to 2½ parts. Sulfate ion content has been reduced from 30 to five parts per million. Non-corrosive to silver, the resistance in the new adhesive has been increased by 12.5 to 1000 megohms. *Pemco Adhesives, Inc.* **P-533**

Two-Part Epoxy

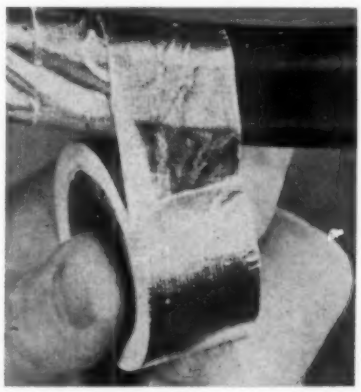
Aluminum bonds exceeding 5000 pounds per square inch are said to be available with Conap 1222, a two-part epoxy. The adhesive is also recommended for use with steel, copper, glass and porcelain. To prepare for use, 100 parts by weight of the base resin is mixed with 25 parts by weight of the hardener and applied with a stiff brush, spatula or roller coater. A one-to two-mil layer is recommended. Contact pressure is sufficient to insure complete bonds; however, pressures of 25 psi will improve the strength. Bonds cure in one hour at 300°F. *Conap, Inc.* **P-534**

Rubber-Resin Cement

Designed for contact work, J-Weld S-837 is a synthetic rubber and resin cement which is solvent cut. Since the base is non-toxic, there is no toxicity in the dried film. Flexible and moisture-and water-resistant, the cement is also fairly resistant to most chemicals, oxidation, oils and greases. It can be used with Formica, Micarta, Masonite and similar materials in addition to wood, fiberglass, plastics, glass, rubber, cloth, leather, and many metals. In application, it is evenly applied to both adherends by either brush or spray and allowed to dry from two to 15 minutes before surfaces are joined under finger or squeeze roller pressure. Materials should be at about 70°F. for best results. *Manhattan Adhesives Corp.* **P-535**

Heat Reflective Tape

Capable of performing continuously at temperatures of 500° to 600°F., Scotch brand Y-9050 heat reflective tape can withstand more than 3000°F. of radiant heat for short periods. The pressure-sensitive tape is designed to reflect extreme heat from motors, wires and delicate structural parts. Exceptionally thin and flexible, the tape will adhere quickly and permanently, states the manufacturer. It is a lamination of .0005-inch aluminum foil to .002-inch glass cloth coated with a white silicone adhesive which converts to silica if burned. *Minnesota Mining and Mfg. Co.* **P-536**



Fast Curing Epoxy

Minit-Cure, a new epoxy adhesive, is said to cure in 60 seconds at room temperature and in 45 seconds if infrared heat is applied. The resin-hardener adhesive system is designed for automatic meter-mixing-dispensing units in rapid production line work. Possible applications include bonding metal to metal, plastic to metal, and plastic to plastic. *Allaco Products.* **P-537**

Rubber-Base Adhesive

A reclaim rubber-base adhesive of thin syrup viscosity for use undiluted, Rez-N-Glue 038 is said to provide flexible bonds to wood, metal or glass. Water-resistant and suitable for use in ambient temperatures of from —20°F. to 150°F., one gallon of the adhesive will cover approximately 250 square feet of surface. Application may be made by brush or spraying with fluid pressure of 25 psi and atomizing pressure of 90 psi. Bonding after about ten minutes is achieved by firmly pressing the adherend surfaces together. *Schwartz Chemical Co., Inc.* **P-538**

Self-Adhesive Material

Available in 33 standard colors and 12 embossing patterns of simulated leather and linen-prints, Deca-Tex is a self-adhesive decorative material that can be applied to clean, smooth, dry surfaces. The protective backing paper is removed and the material is simply pressed into place. Features of the material include a service temperature range of —20°F. to 250°F. and resistance to greases and oils, creeping, fading, shrinkage and abrasion, states the manufacturer. The material may be further processed by silk-screening, hot-stamping and die cutting. *Fasson Products.* **P-539**

Aerosol Contact Cement

Bestwood Spray-A-Bond, a contact cement packaged in an aerosol container, is said to offer high initial bond strength, high resistance to heat, and diminished toxic odor. The manufacturer recommends it for use with metals (including aluminum and its alloys), rubber (including neoprene) and wood, cork, leather, veneering, hardboard, paper, glass, many fabrics and many plastics. The adhesive is also available in non-aerosol containers in sizes up to 55-gallon drums. *Bestwood Corp.* **P-540**

FOR MORE INFORMATION on the new products described on this page use the Readers' Service Coupon on page 56.

• **Italy Very Much Interested in New Adhesives.** The Italian publication, *Il Prodotto Chimico* recently devoted almost an entire issue to the question of the various adhesives. A feature article on "Modern Adhesives Based Upon Neoprene" was published because of many requests from the Italian readers. The author compares the properties of the various polymers with neoprene and enumerates the characteristics of adhesives based upon neoprene. A review of the possible fields of application is given.

A number of chemical industries supplying raw material for the production of adhesives have taken advantage of this favorable trend. For instance the Badische Anilinund Sodafabrik AG in Ludwigshafen advertises a number of its products, underscoring their importance for the production of various adhesives. Ciba enumerates its various products with emphasis on Araldite as an excellent product for formulation of various adhesives.

Other editorial features deal with different kinds of adhesives. It is apparent that the Italian market offers an important outlet for both raw materials and proprietary adhesives.

• **British Article on Epoxies.** Epoxy Resins are discussed by P. A. Dunn in one of the recent issues of *Adhesives and Resins*. The author points out that epoxy resins, as is well known, are basically condensation products of epichlorhydrin and polyhydric phenol (usually bisphenol A). By varying the proportions of the reactants and the reaction conditions, it is possible to produce resins of varying molecular weight, ranging from viscous liquids to high melting point solids. The general formula for epoxy resins is usually represented as an idealized linear structure with terminal epoxide groups, while hydroxyl groups are usually spaced at regular interva's along the chain. In practice, chain branching can occur by reaction between the terminal epoxide groups and the hydroxyl groups in the molecular chain.

Mr. Dunn points out that recent work has produced new types of resins. Possibly the most interesting development is the technique of transforming an olefinic group into an epoxy group, eliminating the use of epichlorhydrin as a raw material.

The uncured bisphenol A epoxies are thermoplastic with poor mechanical strength. They are converted into hard, tough and substantially infusible materials of high molecular weight by reaction with a suitable hardener. The chemical versatility of the terminal epoxy groups enables a large range of chemical hardeners to be employed. These include acids, alkalis and substances containing reactive hydrogen atoms, as well as more specialized substances. Hardeners may react as true catalysts or purely additively or more commonly by a mixture of both processes. The type of hardener selected not only markedly affects the properties of the cured resin, but also affects the application viscosity of the mixture, the usable life, and the rate of cure.

• **Yugoslavia's Fittings Industry a Market For Adhesives.** Because Yugoslavia is a country rich in copper and aluminum, several factories have been built to produce a wide range of fittings. Besides making valves for all purposes, fittings for steam and gas as well as bathroom fittings of all kinds are manufactured. In the production of accessories, aluminum porcelain, fiber, plastics, resins, adhesives and other materials are used. Yugoslav-made fittings and fixtures are being exported to many foreign countries. The most important buyers are the United States (almost 50 percent of Yugoslavia's exports are shipped here), the United Arabian Republic, Iran, Netherlands, Canada and Burma.

Bathroom fixtures produced in Yugoslavia include nickel-plated holders for brushes and glasses, combination holders for sponges and soaps, toothbrushes and so on. Because almost all of these fixtures are now also supplied with an adhesive backing in order to be bonded to the wall without using any screws, Yugoslavia might be interested in establishing contact with American suppliers for the purpose of learning more about the processing and application of these special adhesives.

Any field office of the U.S. Department of Commerce has a trade list containing the names of the Yugoslavia fixture factories. It might be a good idea to obtain this list and to send leaflets and explanatory letters to the various factories.

• **German Plastics Requirements.** Last year German plastics production increased 200,000 metric tons to an annual output to 996,000 tons. In view of the ever increasing domestic requirements, German industry was not able to satisfy the domestic demands and considerable amounts of foreign products have been imported. As usual, America leads with 38 per cent. The largest European supplier of the German Republic is Italy. Great Britain takes second place and France occupies the third position. In view of the keen competition among the German manufacturers quite a number of prices have been cut back.

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THE CURRENT PAUSE IN THE RECOVERY IS ONLY TEMPORARY, say economists in government and industry. They see no cause for worry or change in plans. The pause is normal...a breathing spell...typical of every business upturn. Indeed, the analysts have been expecting some slowing of the Spring tempo. They are also expecting the breather to end very shortly--with the Summer.

> The causes of the Summer slowdown were partly seasonal--the result of vacation shutdowns in steel and other lines, early model changeovers in autos, etc. The breather is also a by-product of the upturn's first phase; a switch from inventory liquidation to accumulation can lose momentum temporarily while waiting for consumers to react to job and income gains.
>
> The Fall improvement will come from three main factors:
> -Business itself will provide lift through stepped-up outlay for inventory, research, and for new plant and equipment.
> -The consumer will respond to longer workweeks, high wages, and new jobs by swelling spending--especially for durables.
> -Federal spending will be the most important--largely those extra billions in defense expenditures prompted by Soviet Russia's repeated and menacing saber-rattling over Berlin.

CONSTRUCTION MAY PROVE TO BE THE BIG SLEEPER of this business rise. It hasn't been getting much attention, but it's roaring along at near-record rates--and at the highest clip in two years. What's more, there are good prospects for substantial increases to come. Spending for public works is up 10% over 1960--mainly highways. Private building is trailing '60 by 2%. Much of the lag is a result of the recession-caused slump in home-building.

> But home-building is now picking up. Lower mortgage rates--and the huge, recently passed housing law--will give demand a big stimulus, with the bulk of the impact hitting in 1962. Home-building helped turn several earlier upturns into booms.

DON'T RULE OUT A STEEL PRICE INCREASE later this year. To be sure, the Administration is putting pressure on the mills to hold the line; and foreign and domestic competition may keep the lid on a few scattered items. But, despite threats of new Congressional anti-monopoly investigations, the producers may find themselves forced to lift prices by new cost increases.

> The companies must increase wages for the third time under the contract signed early last year. Up to now, they have absorbed the hikes, but profit margins are already squeezed. Higher steel prices would lift costs for a big range of U.S. industries--autos, appliances, machinery, and construction.

PRICE AND WAGE CONTROLS ARE BEING STUDIED by government officials for possible enactment by Congress on a stand-by basis in the Berlin crisis. They're not ready to ask for the power, knowing that Congress won't give it short of shooting. But the experts want to determine what would be needed.

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THE BIGGEST LABOR ORGANIZING DRIVE IN U.S. HISTORY is being charted by James Hoffa, recently reelected President of the huge Teamsters' Union. His membership has just voted him broad new powers, plus a large war chest. Hoffa's immediate target is a 300,000 increase in his membership--from the 1.5 million or 1.7 million figure that's variously attributed to the Union.

> The Teamsters will invade new areas--even in manufacturing. Targets will include plants in apparel, textiles, plastics, and in electronics. In general, Teamster organizers will go after virtually any group that's unorganized and organizable.

NEW PROPOSALS FOR HANDLING BIG LABOR DISPUTES will be pushed hard by the Administration and Labor Secretary Goldberg, the proposals' author. They're meant to give the government flexible alternatives to injunctions now called for under the Taft-Hartley Act--something Democrats have wanted.

> Specifically, here's some of the changes being contemplated:
> -Giving fact-finding boards new powers to mediate disputes threatening the economy, plus power to suggest settlements.
> -Permitting longer injunctions than today's 80-day periods.
> -Authorizing temporary seizure of plants pending solutions.
> The issues are too thorny for Congress to act this year, but the groundwork will be prepared for sweeping action in 1962.

UNION LEADERS ARE GROWING INCREASINGLY HOSTILE to President Kennedy, the man they were sure was going to take their policies to the White House. Main cause of their ire is the Administration hold-the-line policy on wages as well as prices, drafted in efforts to check any new round of inflation. Labor chiefs like Walter Reuther fear Kennedy's Labor-Management Commission will be induced to set a policy that will hamper efforts to lift benefits. The labor men are also angry at Kennedy's delay in pushing welfare bills.

THERE'S A NEW NOTE OF CONFIDENCE AMONG KEY OFFICIALS in Washington. Reporters detect this in many areas--especially at State and the Pentagon. It is a notable change from the gloom and nervousness that followed Cuba. Now, U.S. leaders are approaching key problems with steadier frames of mind. They're not all-out optimists. But they feel we can cope with Soviet jabs.

> Passage of time has eased the shock of Cuba and the losses in Laos. Also Kennedy's trip abroad restored relations with allies. And there have been changes in how key policies are made; Kennedy has new advisers and leans on them more and more.

WHO DOES KENNEDY LISTEN TO MOST THESE DAYS? There has been a change of considerable importance in recent months in the names of his principal advisers. The White House assistants are still there and still close to the President. But the words that contribute to major decisions now come from a clearly identified crew outside the White House--mainly the Cabinet.

> Here's the line-up for the key areas of national policy:
> -Foreign policy--It's Secretary Rusk, not Rostow or Bundy.
> -Defense--General Taylor is mapping basic military strategy.
> -Economics--The Treasury's Dillon, not the Economic Council.
> -Politics--Brother Robert is far and away most influential.

Five leading experts report on significant new developments in organometallic research

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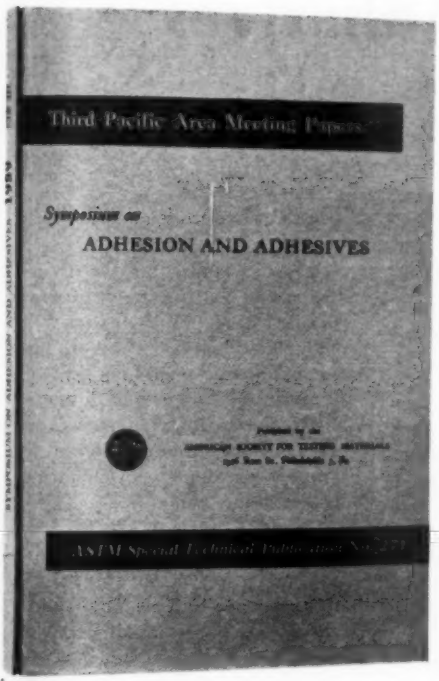
Published by the American Society for Testing Materials



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This volume makes available in printed form material originally presented at the Third Pacific Area Meeting held by the American Society for Testing Materials at San Francisco in October, 1959. It also incorporates data and statistical analysis of a study undertaken to determine the effects of increases in the rate of loading on the strength properties of adhesives.

Although the volume is neither a complete nor an extensive study of the manifold problems relating to adhesives, it does answer some of the many questions of those engineers who have not used adhesives for metal applications and who, with additional encouragement, may incorporate adhesives in their designs.

The volume is a powerful impetus to the use, the technology, and the testing of all adhesives. Metal-to-metal adhesives, relative newcomers to the rapidly growing field of industrial adhesives, have grown in importance to such an extent that no designer can justify overlooking their advantages.

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Lap Shear and Creep Testing of Metal-to-Metal Adhesive Bonds in Germany —By K. F. Hahn, Douglas Aircraft Co.

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Tensile Shear Strength of Adhesive Bonded Metals as a Function of the Rate of Loading—By D. A. George, John Mandel, National Bureau of Standards, and H. R. Butzlaff, A. O. Smith Corp.

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The Use of Infrared Quality Control in the Manufacture of Epoxy Resin Adhesives

By **HENRY LEE**
Technical Director
and
LOIS VINCENT
Research Chemist
Epoxylite Corp.
South El Monte, Calif.

Efficient quality control is a major demand imposed on every adhesives manufacturer. Perhaps no other specialty product is so sensitive to minor shifts in quality of raw materials, to minor amounts of processing contaminants or improper application techniques. Hence, any new method for improving or speeding quality control is of vital interest to the adhesives manufacturer.

Economical methods of accurate quality control are now available to the manufacturer of epoxy resin adhesives via infrared spectroscopy. Our firm has found modern infrared instruments invaluable for quick, efficient control in each phase of operation, from raw materials to finished products. In addition, it is used for scanning new materials, keeping tabs on competition, and as an aid to the chemist in basic research and development.

For most work, an infrared spectrophotometer with sodium chloride separable or closed cells, which scans the infrared radiation absorption of a given material between the wavelengths of 2.5-15 microns, is our most useful tool. For some structural differences, we refer to the far infrared spectra given by the KBr optics, which scans the region of 12-25 microns.

Quality Control of Epoxy Resins —Figures 1 and 2 show infrared spectra of two common epoxy resins. Each batch of incoming raw material is scanned on the IR and compared with reference curves such as these. Conventional "wet" methods for epoxy assay are time-consuming and would not necessarily reveal the presence of diluents or additives. The infrared analysis only takes fifteen minutes plus a few minutes of the chemist's time to interpret the curve.

Quality Control of Curing Agents —Two amines used in epoxy adhesives as curing agents are presented in Figures 3 and 4. They are diethylene triamine and triethylene tetramine. They are similar in odor and appearance and since their molecular structures are so much alike, they have infrared curves very much alike. However, characteristic "fingerprints" in their spectra can be seen at 6.4 microns and 6.9 microns where TETA absorbs more highly than DETA due to its higher ratio of ethylene to amine. Water and other processing contaminants may quickly be spotted also. Hence, despite the best efforts of shipping firms to destroy labels or let drums leak, infrared provides instant identification and quality control.

One of the most satisfying things in infrared work is using it to check new raw materials offered to the trade under super hush-hush proprietary numbers. Infrared can be used to analyze these. If they are a copy of something already studied.

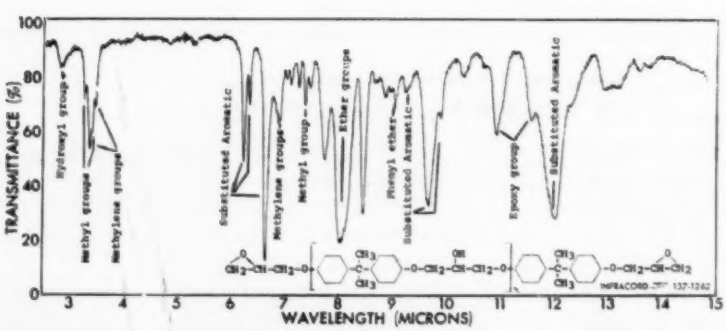

Figure 1—Infrared is useful in identifying resin types. This curve shows the spectrum of diglycidyl ether of bis-phenol A, a low viscosity liquid epoxy resin commonly used in epoxy adhesive formulations.

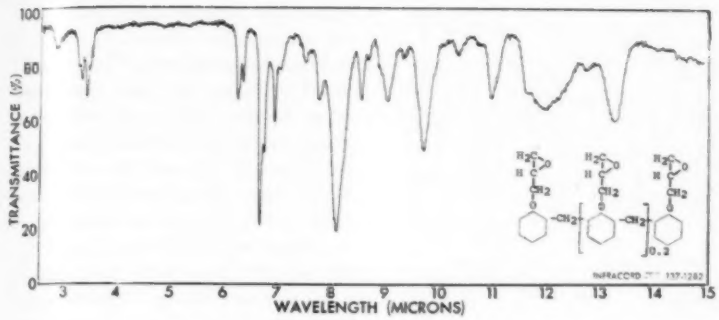

Figure 2—Infrared spectra of an epoxylated novolac, a type of resin coming into use in epoxy resins because of its higher epoxy functionality. Adhesives are especially sensitive to minor shifts in the quality of raw materials.

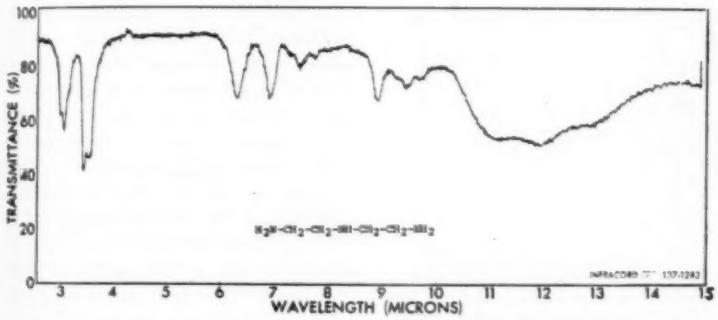

Figure 3—Infrared spectra of diethylene triamine, a polyalkylene amine employed in some epoxy adhesive formulations. Spectroscopy provides adhesive manufacturers with an accurate and economical method of quality control all along the line.

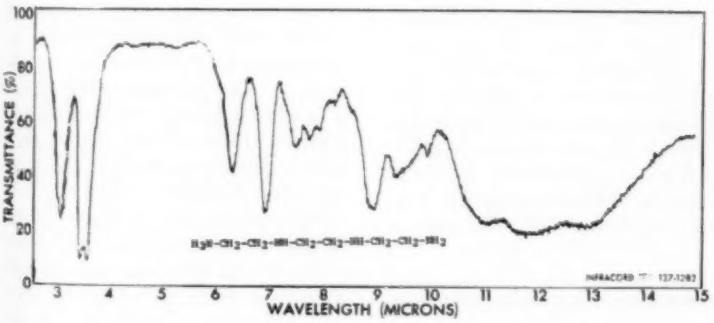

Figure 4—Although this spectra of triethylene tetramine was run in greater thickness than that of the diethylene triamine, the higher methylene content compared to amine content can be seen by comparing the relative absorptions of the amine groups at 6.3 and the methylene groups at 6.9 microns.

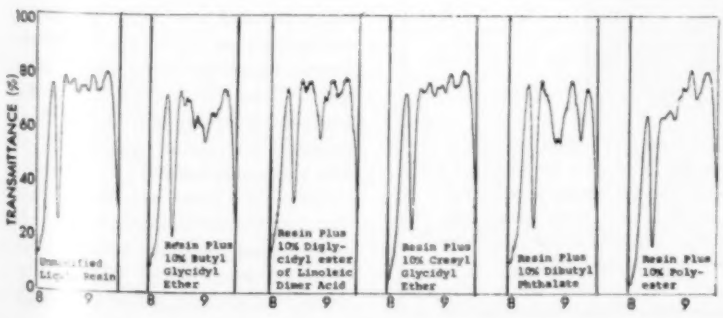
TRANSMITTANCE (%)
Resin Plus 10% Butyl Glycidyl Ether
Resin Plus 10% Diglycidyl ester of Linoleic Dimer Acid
Resin Plus 10% Cresyl Glycidyl Ether
Resin Plus 10% Dibutyl Phthalate
Resin Plus 10% Polyester

Figure 5—The 9-micron region of epoxy resins of the bisphenol A type is very sensitive to the presence of additives. This region changes its shape most markedly with only 5-10 per cent additive.

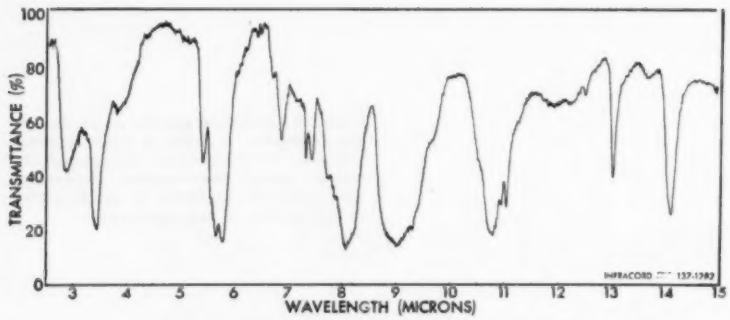

Figure 6a—Reaction of pyromellitic acid with solubilizing polyol immediately upon mixing. Some esterification has occurred as is shown by the ester band at 5.6 microns.

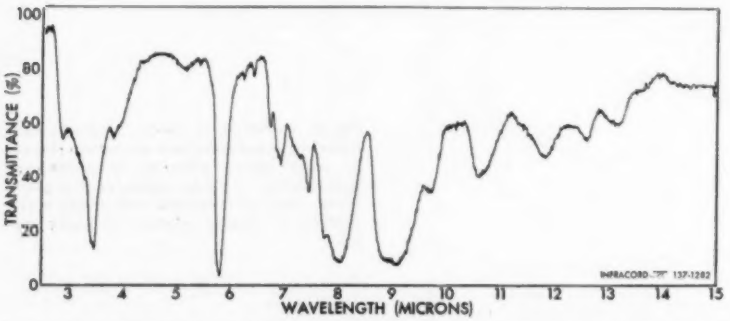

Figure 6b—Pyromellitic acid and solubilizing polyol after reaction for two hours at 250°F. The acid anhydride bands at 5.4 and 5.6 microns have completely disappeared. This spectra technique permits reactions to be easily followed.

much work is saved. If they are something really new, knowledge of their structure permits intelligent planning of research.

Take the case of diluents, which are often used in epoxy adhesives to reduce viscosity. Numerous diluted resins are offered to the trade under proprietary numbers. Infrared reveals just what diluent is used and how much is involved. For example, the 9-micron region in one common epoxy resin (Figure 1) was found to be extremely sensitive to even low concentrations of diluents. The spectrum changes rapidly from that of pure resin, and changes in a different way for essentially each different type of diluent employed. Figure 5 illustrates the 8-9.5-micron region for a resin with five different diluents.

Infrared can control "in process" manufacturing. Recently, there have been some commercial efforts to make pyromellitic dianhydride easier to handle by partially reacting it with polyethylene glycol. Infrared is used to determine the end-point of the reaction as follows: Figure 6A shows the materials immediately after mixing. Figure 6B is the spectra of the reaction after heating one hour at 250°F. Unreacted hydroxyls absorb at 2.85 microns. This band disappears as the reaction goes to completion, as do the anhydride bands at 5.4 and 5.6 microns.

Infrared takes the gamble out of shipping finished products. A routine infrared check on a batch can spot mixing errors almost before they happen. Figure 7 shows parts of the spectrum of a pure resin with ten, 20 and 30 per cent flexibilizer, illustrating the quantitative nature of IR. The band at 5.8 microns is characteristic of the modifier and the band at 6.6 microns is assigned to the aromatic groups in the epoxy resin.

Notice how the band at 5.8 microns lengthens in proportion to the band at 6.6 microns as the amount of flexibilizer increases. By measuring the ratio of the absorbance at 5.8 microns to the absorbance at 6.6 microns and comparing the ratio with known values, it is possible to estimate quantitatively the amount in the finished product to see if it is properly made.

Infrared is also a working detective for us in technical service work for checking on adhesive applications. Recently, an epoxy sealant was applied to a plywood apartment house deckway. One corner showed evidence of poor adhesion, so a piece was lifted and brought into the laboratory. An infrared curve showed the sticky substance on the bottom of the piece of coating to be pure curing agent from the "B" part. In other words, the workmen applying the material had failed to mix it thoroughly. The result was bond failure.

Naturally, there are many times when everyone doing adhesive research must depend on more conventional methods of testing. Viscosity, potlife and gel time must all

About the Authors . . .

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LOIS VINCENT holds a BS in chemistry from the University of Illinois. Before joining Epoxylite to do research on epoxy compounds, her work experience included three years in the paint industry.

be checked by viscometer and stopwatch on the actual materials in the laboratory. No infrared curve can completely predict the precise bond strength which a given adhesive will take before failing. It is necessary to prepare lap shear panels and pull them on a tensile tester before a compound may be proven.

However, the infrared spectrophotometer is especially suited to many aspects of adhesive research. The two separable rock salt cells used in IR work duplicate the faying surfaces of an adhesive joint, and the dissipation of exotherm is similar to that encountered in actual use. By running curves periodically on the same pair of cells held together by the experimental adhesive, it is possible to watch it cure and determine the minimum cure cycle.

Cutting Time Required

The same results can be obtained by laying up several hundred lap shear panels, curing them over a wide range of conditions and pulling them. This represents several weeks work. Infrared permits the work to be completed in one man-day or less.

In one case, for example, a customer wished to know the minimum cure time at 400°F. for a certain adhesive. Figure 8A is the spectrum of the freshly applied material. Figure 8B is the curve run after 20 minutes at 400°F. and Figure 8C is a curve of the completely cured epoxy adhesive, achieved after one hour at 400°F. The chemist's time for this particular investigation totalled less than 20 minutes and total cost was less than a tenth of the cost of physical testing.

The initial cost of the infrared machine is rapidly justified when a company uses it in this fashion. The time saved is almost beyond measure. A half-hour of a chemist's time reading one curve can and has saved a month's laboratory work many times. Valuable laboratory time and space can then be devoted to developing new products and serving our customers better.

Literature Reference

(1) Henry Lee and Kris Neville, Epoxy Resins — Their Applications and Technology, McGraw-Hill Book Co., New York, N.Y., 1957.

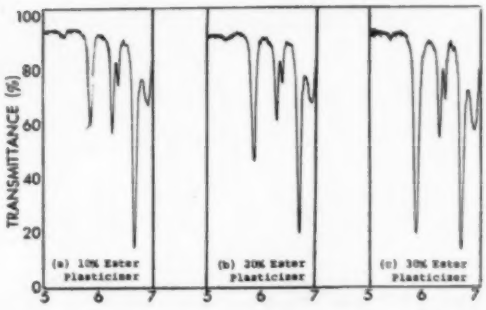

Figure 7—Parts of a spectrum of a pure resin with ten, 20 and 30 per cent flexiblizer.

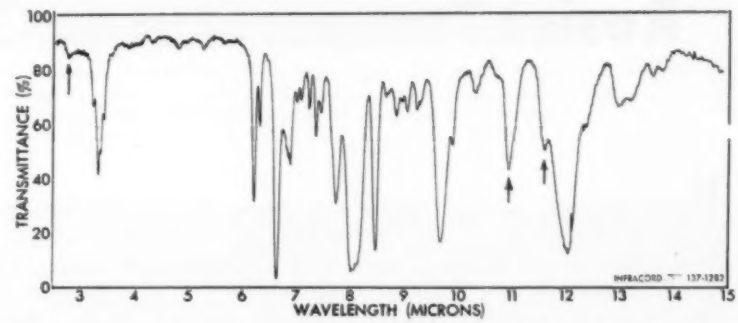

Figure 8a—Spectrum of a freshly mixed and applied epoxy adhesive. This figure and the following two were used to work out minimum cure times of the epoxy at 400°F.

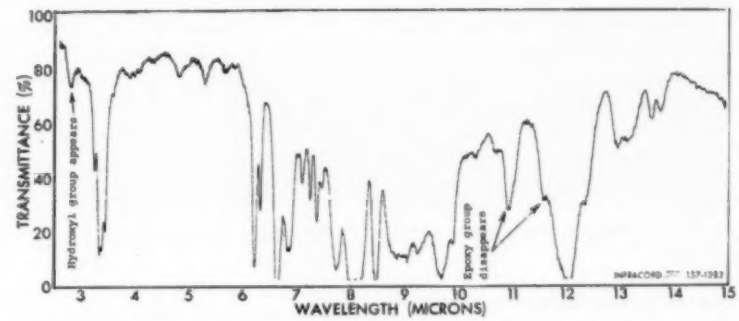

Figure 8b—Spectrum of the same epoxy adhesive formulation after 20 minutes at 400°F. Total time for this investigation was less than 20 minutes.

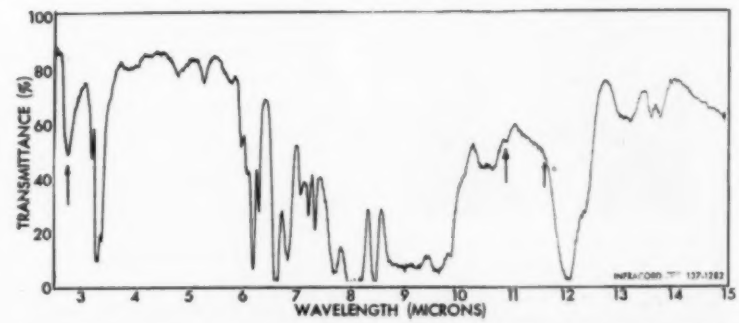

Figure 8c—Last spectrum of this series was made after one hour at 400°F. Cost of the entire investigation was less than a tenth of physical testing costs.

By KURT W. CORNELY
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American Thermocatalytic Corp.
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Developing Special Cements to Resist Temperatures Over 4000°F.

Early in the development of high temperature radiant reactors as used in the Thermocatalytic combustion process developed by American Thermocatalytic Corp., the need for a "sealant" or adhesive having properties far superior to those of commercially available products became apparent. The cement was to be used in mounting a Pyrocore reactor onto a ceramic support at the exhaust end, and onto a flexible support at the intake. A glo-coil igniter was also to be inserted and sealed with the cement.

Available high temperature refractory cements left much to be desired. In addition to mechanical failures, these cements were subject to phase and chemical changes at high temperature, including interaction of cements and components in oxidizing or reducing atmospheres, and fluxing of cements. Faced with the necessity of solving or at least obviating all the above failures in order to successfully apply the Thermocatalytic process, chemists at American Thermocatalytic Corp. undertook to formulate a stable, high temperature, refractory cement which would withstand both continuous service temperatures over 4000°F. and repeated severe thermal shock.

Our attack on the problem was to first utilize materials having high melting points. This involved a careful screening of the literature and finally narrowing down the possibilities to the oxides and silicates of elements in the periodic family of group IV. Once this was established, we next experimented on varying compositions of the oxides and silicates of group IV, and varying binder compositions, until promising formulations were developed. This was followed by a refinement of the promising formulations to ultimately yield Astroceram cements. We found that they offered excellent characteristics not only for the radiant reactors, but for other applications as well.

The most outstanding characteristics of the cements reside in their resistance to high temperatures and heat-shock, and the fact that they do not react (or cause reactions to take place) in contact with metals or ceramics. This latter quality is due largely to the fact that the cements form "saturated" compounds. Since minor changes in composition have shown remarkably great deviations from optimum properties, mixtures are critical and these products are sold pre-mixed, consisting of solids in liquid reagent vehicles.

Astroceram cements offer a maximum service temperature of 5300 °F. Their coefficient of thermal expansion was determined to be 5 x 10^{-9} in. per degree Fahrenheit. Thermal neutron cross section ranges from 20-30 Barns and thermal conductivity is in the order of 23.2 Btu/hr. (ft.^{2}) (°F./in.)

Testing Mechanical Properties

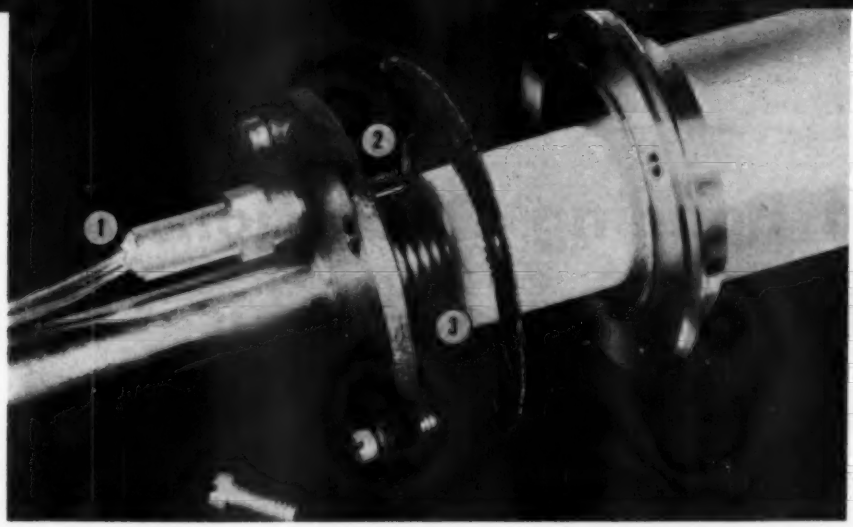
Tests of their mechanical properties revealed that Astroceram cements possess a hardness of 8-9 Mohs; tensile strength of 10,000 to 15,000 psi; compressive strength from 80,000 to 150,000 psi. Modulus of rupture was found to be close to 23,000 psi, and porosity from 0-0.2 per cent.

Electrically, the cements offer even more startling characteristics. Dielectric strength is 200-300 volt/mil, with a dielectric constant of approximately 9.0 at 60 cps and from 7.0-9.0 at 10^6cps. Arc resistance tests resulted in a showing of over 500 sec. Volume resistivity proved to be 10^{13} to 10^{15} ohms/cm.

Chemically, the cements exhibit

About the Author . . .

KURT W. CORNELY received his BA from Adelphi College and his MS from Pennsylvania State University. He has experience in adhesives, protein chemistry and ion exchange.



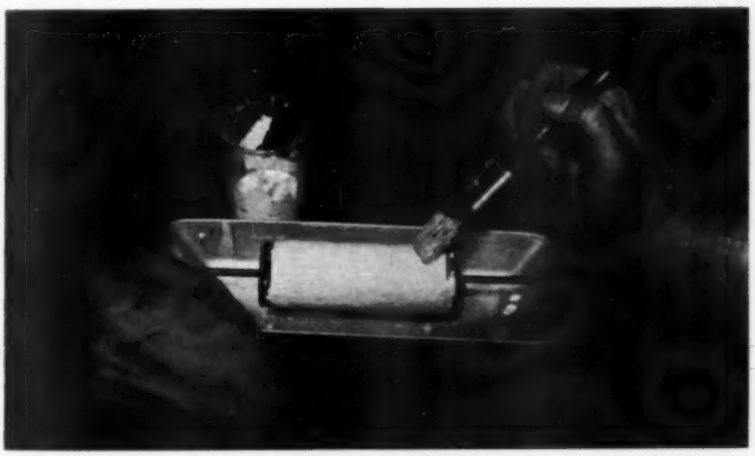
The Pyrocore reactor is mounted onto a ceramic support at the exhaust end and a flexible support at the intake end. The above view of a portion of the unit shows three different bonds: (1) wires cemented in position, (2) the bonded igniter and (3) the bond to the support.

some unique characteristics. They are soluble in hydrofluoric acid, but only slowly soluble in concentrated boiling sulfuric acid, and insoluble in hydrochloric acid, nitric acid, phosphoric acid and sulfuric acid at room temperature. They were also found to be resistant to carbon monoxide, carbon dioxide, water, oxygen, and hydrocarbons at temperatures over 1800°F. Additional resistance to sulfur and arsenic at 1800°F. has been confirmed. They react with carbon at temperatures over 3000°F.

Recent tests also confirm excellent resistance to radiation in reactor work.

Two basically different types of cement are presently available: Type A, which can be air-dried, and has a maximum service temperature of approximately 4300°F.; and Type B, which must be fired to achieve a bond, and is for use at temperatures up to 5300°F. Recent additions to these basic compounds include types "A-LP" and "B-LP"; (the LP suffix standing for "low porosity") which are intended as vacuum sealers.

Thermocouples have been successfully encapsulated with Astroceram ceramic and metal sheaths, resulting in improved heat transfer, and chemical and thermal resistance. In this connection, it has been used in wire casing, and Ceramo wire end seals. At the present time Astroceram is under serious study in the atomic energy field, and to determine its adaptability for the manufacture of missile nose cones.



In making tubes of Astroceram simple devices can be used. In the photo above a cardboard tube is rotated in a trough to apply successive layers of cement.

Once the tube has reached the required thickness it is fired so that the cardboard form disintegrates. If desired the form can be ground with a diamond wheel.

Wood Bonding Operations in Quality Furniture Production

A switch in adhesive resin eliminates "bleed through" and provides a production bonus in that it can be used in both hot and cold curing systems

"Quality furniture requires both quality workmanship and quality materials all the way down the line," explains Colon Prestwood, plant superintendent of Bernhardt Furniture Co., Lenoir, N.C., "That's why before accepting an adhesive we submit it to a ten-cycle soak test."

Each cycle of the test consists of soaking a laminate in water for two hours and then baking it at a temperature of 200°F. To meet Bernhardt standards, laminates must withstand five to six cycles before beginning to delaminate. Plyamine 6910, the adhesive now used in all Bernhardt machine-gluing operations, consistently withstands from nine to ten cycles before any separation occurs, Prestwood reports.

Growth of Firm

In the last half century, Bernhardt Furniture has grown from a small chair manufacturer to one of the world's largest producers of dining room furniture. It offers a wide range of styles in both the traditional and the modern manner.

Machine-gluing operations at Bernhardt Furniture include flat laminated work, curved laminated work and laminated cores. Before the switch to the present adhesive system, flat laminated work, which is slow dried without heat, had been a particular problem because of "bleed through."

Flat laminated panels are used in table tops, buffet tops, drawer bottoms and fronts, and similar applications. They are five-ply laminations consisting of a 1/20-inch back, a 1/28-inch face, two pieces of 1/20-inch poplar cross banding, and a core of 11/16-inch tupelo gum lumber.

Only the cross banding passes through the glue spreader where both sides are spread simultaneously. Approximately 40 pounds of adhesive are required for every 1000 square feet of board.

Panels are then assembled in the proper laminating sequence and stacks of five-ply laminations are clamped under a pressure of 150 to 200 pounds per square inch, and allowed to cure overnight.

"It is during this period," Mr. Prestwood points out, "that bleed-through can really ruin us. Our old adhesive would often seep through the 1/20-inch face and bond the entire panel to the bottom of the panel above." At one time, Bernhardt Furniture had to reject from ten to 15 per cent of all panels due to damages caused by prying stuck panels apart.

Plyamine 6910, a liquid resin, offers a particular production advantage in that it can be used for hot curing as well as cold curing by merely changing the catalyst, Mr. Prestwood emphasizes. Therefore, the same adhesive used in flat laminated panels can be used for making up curved lamination work—drawer fronts, table rims, etc.—which must be cured in a steam-heated hot press. Incidentally, the unit used for this application is a converted cold press in which hot plates surrounded by steam jackets have been installed.

Curved laminates may have from nine to 15 plies, although 95 per cent of the work at Bernhardt Furniture calls for only nine plies. The layup method used is essentially the same as that employed in flat work. Panels are then cured for four minutes at temperatures ranging from 300° to 325°F.

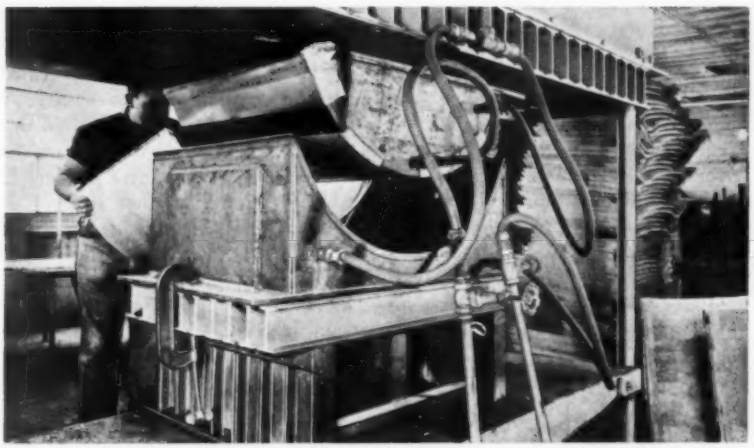
Laminated Cores

Laminated lumber cores are produced in sizes ranging from 17 to 72 inches long, and from 20 to 33 inches wide. The pieces are pre-cut to the desired size and fed to the gluing machine by an automatic conveyor. They are passed over a glue roller which applies adhesive to only one edge. Next, the pieces are fed into a Panel-Flo machine. Finally the assembled sections pass through a 20-foot oven heated to 400°F. Since the pieces pass through the oven at the rate of ten feet per minute, only two minutes are allowed for complete cure.

Resin shipments to Bernhardt Furniture are stored in two 10,000-pound tanks connected to the gluing department by piping. The resin is mixed as needed in a 30-gallon mixer where extenders and catalysts are added to meet the requirements of the specific operations.

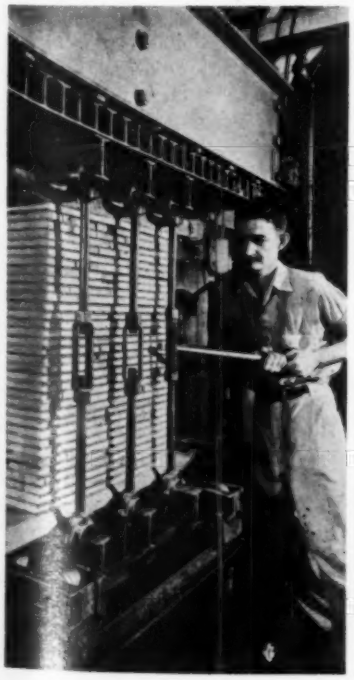
Operators are shown passing 1/20-inch cross banding through the Black Brothers glue spreader prior to assembly into five-ply panel. Only cross banding is spread.

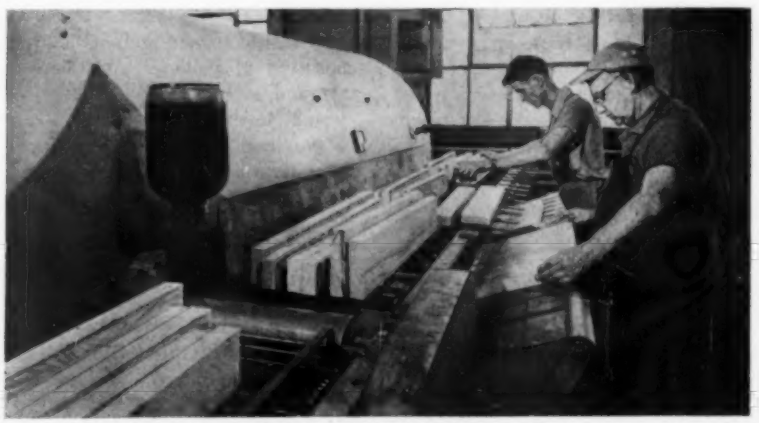
Resin is piped to glue room from 10,000-pound storage tanks for mixing with extenders and catalyst prior to use.



The steam-heated hot press shown here cures nine-ply curved laminated table rims at 300° to 325°F. in four minutes. It is actually a converted cold press.

Stacked panels are held under 150 to 200 pounds of pressure by 36-inch retaining clamps during overnight cure.





The feed end of the Bernhardt Panel-Flo machine. Core stock passes over glue roller and is then fed manually into unit. Assembled sections pass through oven.

By O. Z. TYLER and R. S. DRAKE
B. F. Goodrich Chemical Company
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Superior Strength Properties with Polymer-Modified Portland Cements

Polymer-modified cement systems have been gaining increasing acceptance during the past few years because of their advantages over ordinary concretes. These advantages include improved adhesion to previously laid concrete, greater dry strength, increased abrasion resistance and greatly reduced dusting.

Latex and liquid epoxy systems have led the way in this field. Products based on these polymers have been in commercial use for more than five years. Of the latex products, the most popular are based on butadiene-styrene and vinyl acetate polymers.

Latex-modified concretes offer a quick, serviceable method of patching old concrete without the need for extensive surface preparation. This provides the strongest impetus for the use of latex in concrete. Building and maintenance contractors found that steps and heavy-duty floors made from modified cements gave such excellent long-term, trouble free service that the increased cost was justified.

However, polymer-modified cement systems have remained in a small use, highly specialized category. Their use today is estimated at slightly less than five million pounds per year, while other concrete additives which provide similar strengthening and hardening effects are used at annual rates of eight to ten times this figure.

The basic impediment to growth of the present polymer systems is one of cost versus properties produced. For years, concrete makers have strengthened their product by simply adding another sack of cement. Other strengthening and processing aids such as calcium lignosulfate (increases cohesive and compressive strength), gypsum (slows down drying, thus assuring good wet-cure strength) and sodium silicate (hardens surface, overcomes dusting), are materials in the same cost range as cement.

Increased Costs

Polymer additives are not only several times more expensive than these materials, but effective amounts are so large, (15-20 per cent of the cement weight) that the addition of polymer adds between six and seven dollars per hundredweight to the cost of cement. Thus, a polymer additive would have to provide a superior array of properties to gain a substantial share of the market.

The present market, which depends chiefly on one property of the polymer-modified cements, *i.e.*, adhesion, would probably always remain small with the heretofore available latex polymers.

However, the uses for specialty, high-grade cementitious systems are many, and it can be expected that new polymers which are better cement additives than the present materials will replace these polymers and expand the polymer additive market.

The definition of the additive problem then lies not only in a survey of costs, but in a definition of the cementitious systems in which polymers are used and in the properties which various polymer additives impart to these systems.

Portland cement, a common construction cement, is made from a burned and ground mixture of limestone and any of several other materials such as clay, slate, chalk, or blast furnace slag. The cement gains its strength through a complex reaction of water with calcium and silica oxides.

Maximum strength is reached by curing under water. Unmodified Portland cements take a number of days to reach maximum strength with reaction half complete in three to four days and essentially complete in one month.

A pure mortar contains only Portland cement, sand and water. Pure concrete contains cement, water and any number of large size aggregates such as gravel, broken stones, cinders and so forth. These systems are modified with additives which either improve the course of the natural reaction, or provide additional beneficial chemical or physical reactions.

Generally, chemical additives either retard or hasten the rate of evaporation from the cement system. Some also perform additional tasks such as air-entrainment. Characteristically they promote the natural reaction and do not strengthen the system in themselves. This is a major reason why these additives can be effective in small amounts, often only one to two per cent of the total cement weight.

Polymeric additives, however, strengthen and improve cements by imparting some of their own physical properties to the cement system. The most characteristic property of all these additives is increased adhesion. This is represented by improved adhesion of the polymer modified cements to other surfaces and by improved internal tensile and compressive strengths.

Polymer particles dispersed in a cement system bond tightly to the cement particles around them. Increasing polymer quantity increases the number of cement particles that are bound and at a certain level of addition a strengthening system of polymer-cement-polymer chains is formed.

Substantial Amount Needed

Thus, the strengthening effect of polymers depends on their forming an appreciable part of the total cement system. Substantial amounts of polymer addition are needed to gain improved cement properties and usually total 15-20 per cent of the total cement weight.

Most polymer additives also beneficially affect the natural cement-hydration reaction. The polymers appear to retard evaporation and meter the hydration water as needed. A major advantage of this water control is that allowing the cement to set undisturbed (dry curing) produces a maximum strength system. In addition, the rewetting and covering (wet curing) necessary for high quality unmodified cements is unnecessary and is actually undesirable for polymer modified systems.

The polymer types which have been used as cement additives are:

Latex Additives—A latex polymer, being a water dispersion, is a natural type of additive for cement systems. Butadiene-styrene and polyvinyl acetate latices are the most commonly used at present.

In general, both latex types are engineered to be stable to the high concentrations of soluble ions (electrolytes) present in cement systems. Polymers are intermediate in molecular weight and have high elongation but moderate tensile strengths. Particle size is controlled at between one and five microns. Commercial latices are supplied with acid or alkali systems.

The compressive strength of a typical modified cement, containing 20 per cent latex solids by weight, increased about ten per cent over a regular (wet-cured) cement.[1] The tensile strength increased about 25 per cent, flexural strength over 100 per cent and bond strength over 130 per cent.

Latex-modified cements require less water than ordinary cements and latex-cement mixtures normally maintain equal workability with about 30 per cent less water.

Dry-cured modified cement systems have as major characteristics excellent adhesion to a variety of surfaces, high strength and good dimensional stability. Cement patching and resurfacing compounds must possess all these properties. This is the largest use for latex-modified cements.

However, there are some indications that butadiene-styrene and polyvinyl acetate latices are water sensitive. For instance, modified cements based on either latex will not produce high strength, wet-cured cements. These modified cements will also lose a portion of their strength when rewet after dry curing. Polyvinyl acetate modified cement systems, for instance, abrade very rapidly when wet. Consequently, while some modified cements have performed well, others were unable to combat the stresses of outdoor weathering and pronounced failures have resulted.

Epoxy Additives — Epoxy-modified cements, applied to a properly prepared cement surface will achieve an adhesive bond with higher strength than that of the internal bond of the cement. This high bond strength does not change appreciably on aging or outdoor weathering, and many epoxy patching and resurfacing compounds have given excellent five year service.

Not a True Cement

The common epoxy compound is not a true cement since it contains no Portland cement and the resin provides all of the adhesive power. Consequently, economics dictate that epoxy compounds be applied in thin sections, generally ⅛-⅜ inches thick. If uneven surfaces are to be coated, a highly loaded epoxy filling compound is applied followed by a standard formula (topcoating) which acts as a sealer and wear coat.

Epoxy cement compounds cure at room temperature, adhere tightly to all types of paving materials, have high mechanical strengths and are extremely insensitive to water and chemicals. In addition, their co-

About the Authors . . .

ORVILLE Z. TYLER, III, received his BA in chemistry from Bowdoin College. After service in the U.S. Army Chemical Corp he joined Goodrich as a development chemist and is now a vinyl latex product engineer.

RALPH S. DRAKE is a graduate of Case Institute of Technology from which he received his BS in chemical engineering. He is now engaged at Goodrich Chemical in the synthesis of new synthetic latex polymers.

Figure 1—

Properties of Geon 450X17

Total Solids (min. at shipment)	48-51%
pH	7.5
Viscosity (Brookfield at R.T.)	14 cps
Specific Gravity of Latex	1.14
Specific Gravity of Solids	1.37
Minimum Film-Forming Temp.	70°-80°F.
Optimum Fusion Temp.	70°-80°F.
Tensile Strength (range)	2100-2600 psi
Elongation (average)	390%
Clarity (light transmittance)	92-95%

Figure 2—

Sample Preparation Mold

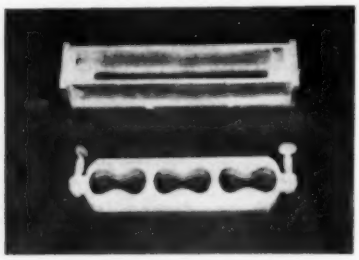


Figure 3—

Possible Tension Test Breaks

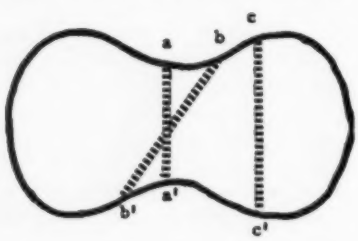
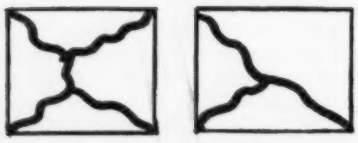


Figure 4—

Types of Compression Breaks



efficient of expansion is approximately the same as Portland cement concrete. Very thin layers of epoxy compounds make excellent wear and skid resistant coatings. They are chiefly used in specialty applications such as bridge decks, toll booth lanes and loading ramps where weight or skid resistance are at a premium.

Epoxy cement compounds generally contain a liquid epoxy resin, a curing agent, usually an aliphatic amine such diethylenetriamine, and an aggregate having an eight to 40 (1/8"-1/32") mesh size. Special purpose formulas may also contain flexibilizers, *e.g.*, polyamide; accelerators, *e.g.*, resorcinol; liquid extenders, *e.g.*, coal tar; and color pigments.

The thinnest resin coats are applied by spreading a layer of a resin/curing agent blend on the surface and then broadcasting the aggregate over it as the resin starts to harden. Adding aggregate before application greatly increases mixture viscosity. Thicker coats are applied by trowelling.

There are a number of disadvantages to the use of epoxy cement compounds, most important of which is cost. Epoxy resins are by far the most expensive materials used in cement patching and surfacing compounds. The cost of epoxy resins averages 25 per cent greater than other polymer additives. Epoxies cannot be used to strengthen ordinary cement systems because appreciable quantities of water inactivate them. The epoxy resin alone supplies strength to the compound.

These compounds can tolerate only moderate loading and the maximum resin/aggregate ratio for serviceable surfaces is about 1/10. Also, the curing agents, flexibilizers, accelerators and so forth used in compounding are all relatively expensive chemicals which must be used in fairly large quantities to be effective (10-100 phr or parts per hundred parts of additive), while the low-cost extenders, such as coal tar, have a practical use level of about 100 phr.

The excellent adhesion that is feasible with the epoxies depends entirely on the preparation of the surface. Adequate bond strength for bituminous concretes can be gained by detergent cleaning. Portland cement concretes require mechanical abrasion of the top surface or acid etching to obtain adequate adhesion. Rough and uneven surfaces must be given this treatment plus a coating of resin because the highly-filled epoxy compounds used for leveling will not develop adequate adhesion unaided.

Other difficulties include short pot life of resin/curing agent blends, long cure times for unaccelerated systems at temperatures below 60°F. and high viscosity of highly-filled compounds.

Increased Sales

While sales of epoxy resins for cement applications are growing and properly applied compounds are considered completely reliable, these objections should continue to restrict the scope of the market for these materials.

Water Soluble Resins—Water soluble resins are generally of two types. Resins, such as methyl cellulose, hydroxy ethyl cellulose etc., have been used for some time to retard water evaporation thus promoting the setting of Portland cement in applications such as tile pointing compounds[2] where the water demand of dry tile and the open air are severe. These resins are added in low percentage (two per cent) solutions and low weights of addition (1.5 per cent dry). They provide no strength to the system by themselves and cannot be considered as polymer additives within this article's scope of definition.

Two types of water soluble resins which do strengthen the normal cement structure are certain types of highly hydrolyzed polyvinyl acetate resins and low molecular weight polyacrylates which possess some ability to crosslink.

Probably the major advantage of these resins stems from the way that cement patching and surfacing compounds are merchandised. Usually, only small amounts of compound are needed and separate containers with cement and aggregate and compounded polymer are sold. A water soluble resin can be mixed with the dry ingredients to eliminate one package. The patching

compound then becomes a one package system which can be used by simply adding water.

The major disadvantage of these resins is their continued water sensitivity after drying. Both types tend to redissolve on exposure to water and can cause drastic reductions in properties of modified cements.

A few years ago, when polymer additives for cements were still largely in the development stage, B. F. Goodrich Chemical Company undertook an extensive screening of its products as cement additives. These preliminary tests indicated that vinyl chloride copolymer latices developed unusual strength and binding properties in modified cements. The most outstanding discovery was that dry-cured and wet-cured modified cements reached almost the same levels of strength improvement. This was in marked contrast to other types tested, including commercial latices used as cement additives, which showed poor wet-cured strength.

Higher Strength

Tensile strengths of the vinyl modified cements were higher than unmodified cements cured under ideal conditions (under water). However, dry-cured tensile strengths were generally lower than those of cements modified with commercially accepted latices.

A subsequent development program revealed that a blend of Geon 450X17, a vinyl copolymer, with a polyvinyl acetate latex improved dry-cured strengths without changing wet-cured strength essentially.

The ability of latex-modified cements to cure without rewetting is one of their strongest features and high wet-cured strength is no advantage in itself. However, high wet-cured strength is indicative of high water resistance and this property has great influence on the outdoor weatherability of modified cements.

Laboratory and field evaluations have indicated that the new latex type shows great promise of expanding the market for latex modified cements. Some of these tests are pictured, discussed and compared to similar tests on popular commercial latices in the following data.

The concept of a latex-hydraulic cement system is not new. The practical development of cement-latex compositions has taken place over the last three decades, and although earlier patents and literature references exist, real interest stems from the data of Bond's specification (B.P. 369561, 12/17/30).

Prior to this, researchers generally supposed that natural rubber latex and cement were incompatible. Most compositions yielded upon mixing a heterogeneous mass which, if the cement predominated, produced a weakened cured concrete structure. If the rubber predominated, its usual physical properties were degraded by the presence of large cement particles. At that time little practical outcome of this application area was anticipated.

About 1930, demonstrations were made showing that of a well-stabilized, concentrated natural latex (five per cent casein calculated on the rubber) were combined with hydraulic cement in place of the usual gaging water, a paste was obtained which remained trowelable for a reasonable length of time. It was suspected that the water in the latex would hydrate the cement in the usual way. It is now known that in such compositions, particularly with applied pressure, the latex is the continuous phase and has hardened cement particles dispersed within it that provide a very resilient structure.

After this original work with a compatible composition, a wide range of applications was uncovered and reported as considerable literature demonstrates. Although these materials could be used for foot and light-wheel traffic, they never reached the stage where hardness and strength were sufficient to withstand average road traffic.

The later work of Stevens,[3] Griffiths,[4] [5] and van Gils[6] concerning the uses and applicability of natural rubber latex and hydraulic cement compositions must certainly have encouraged manufacturers of synthetic latex types to examine this application area as a means of commercial development.

The work of Geist[7] *et al.* showed the effects of polyvinyl acetate emulsions as mortar admixtures. Microscope examination has shown that polyvinyl acetate emulsions strengthen cements by filling the pores of the cured Portland cement structure. Parallel work has shown that polyvinyl acetate emulsions as mortar admixtures have one extreme disadvantage—poor wet-cure strength. This, no doubt, has been found true of other latex types also.

A more recent review of the literature concerning the use of polyvinyl acetate emulsions has been made available through the Corps of Engineers,[8] United States Army. Their conclusion parallels that of earlier thinking: Because of inherent characteristics polyvinyl acetate emulsions lack the ability to resist water. Despite the unusually high dry strength increases, this one major disadvantage has somewhat dampened the applicability of this latex type.

Gaining Popularity

Butadiene-styrene latex has gained considerable popularity in this field. Little published information is available other than sales bulletins. Its use with Portland cement appears to have found practical outlets in resurfacing and refacing treatments as well as improved mortars for mansonry.

A recent composition and application patent[9] demonstrates how a latex polymer can be tailored for a specific application such as a Portland cement admixture. The invention relates to an improved composition and method of sealing the annular space between the wall of a well hole in the earth and a casing placed within.

This brief background has in part influenced and guided the development of the latex under consideration here, *i.e.*, Geon 450X17. The latex contains both anionic and nonionic emulsifiers to provide maximum chemical stability. Geon 450X17, an internally plasticized vinyl copolymer latex, has the properties listed in Figure 1.

Geon 450X17 latex has exceptional resistance to water and each of its component monomers possesses good chemical resistance in the polymer form. The following sections of this work deal with the

Figure 5—Tensile and Bond Strength for Unmodified Mortars with Variable Water/Cement Ratios

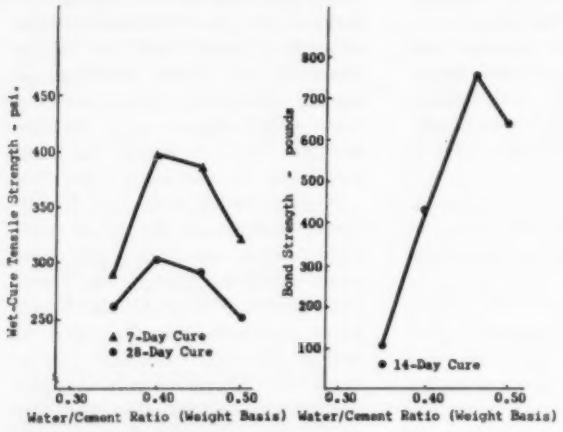
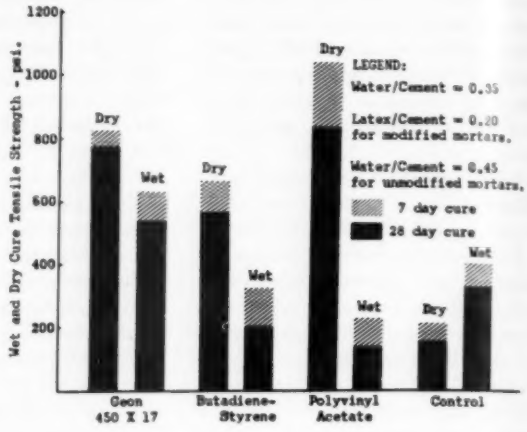


Figure 6—Wet and Dry Cure Tensile Strengths of Various Latex-Modified Mortars



physical and chemical properties of Portland cement mixtures containing Geon 450X17 as an admixture.

The preparation and testing of samples for various physical strength determinations were carried out according to the following methods. ASTM approved or ASTM modified procedures were employed wherever possible.

A general, suggested formulation for duplication of the results in this work is given below. The quantities shown represent parts by weight.

Ottawa sand (20-30 mesh): 300.0 dry, 300.0 wet.

Portland cement: 100.0 dry, 100.0 wet.

Latex (50 per cent total solids) in a water/cement ratio of .20:20.0 dry, 40.0 wet.

Water (water/cement = 0.30): 10.0 wet.

Ottawa sand (20-30 mesh size) was used because of its dependable uniformity. Ordinary, grey Portland cement was used.

Tensile Strength—ASTM—C-190-58—Standards 1958 — A briquet gang mold (Figure 2—foreground) is used to prepare the samples. In all cases samples are given one of two cure treatments after they have been in the mold for 24 hours:

(1) Wet Cure—7 or 28 day immersion in 70°F. water.

(2) Dry Cure—7 or 28 day curing at 65 per cent relative humidity and 70°F.

The samples were pulled at the rate of 10 pound/second and an elongation rate of 0.05 inch/minute on the ASTM-designated apparatus. With many latex-modified mortars breaks occurred in places other than the one square inch cross sectional area of the sample.

Breaks Summarized

These erratic breaks are summarized as follows: (Refer to Figure 3). The rupture should take place along lines a-a′ rather than b-b′ or c-c′. Since the cross sectional area at a-a′ is one square inch the testing machine reading in pounds is numerically equal to the stress in pounds per square inch.

Bond Strength—ASTM—C-321-54T—Standards, 1956—This bond strength method is based on cementing two crossed red shale bricks with an even layer of mortar, allowing to cure for 14 days at a constant temperature and relative humidity, and then testing and measuring the amount of pull required to separate the two bricks. After washing and drying, the bricks are marked to make certain they will be at right angles with each other.

The contact points for the special test head used with the Baldwin Testing Machine—made by Baldwin Locomotive Works, Philadelphia, Penna.—are located at the ends of the bricks. This test can give erratic data due to possible irregularities in the surface of the bricks causing the mortar layer to be uneven in thickness. This results in a stress concentration which causes separation of the bricks at a lower-than-normal reading.

Flexural Strength — ASTM—C-293-54T—Standards, 1956 — This test was performed on concrete samples only. Its method of flexural strength measurement incorporates the simple beam with center-point loading. The modulus of rupture is calculated from the load in pounds required to break the sample 11.22″ long by 2″ wide and by 2″ deep. These samples were given the same curing treatments as tensile briquets. The flexural strength mold is shown at the rear of Figure 2 which appears on page 32.

Compression Strength—ASTM—C-116-49—Standards, 1956 — This test utilizes the portions of the beams broken in the flexural strength test described above. The ultimate compression strength is the only one determined. The reading from the machine in pounds is divided by the total area of contact in square inches (the average of the top and the bottom areas of contact) to give a compression strength in psi.

Various kinds of breaks—splits, shear, cone and shear-cone—which occur during compression testing are shown in Figure 4. The "cone"

break is evidence of good materials and a well-prepared sample.

Adhesion to Old Mortar—A modified ASTM procedure for tensile testing (C-190-58 — Standards, 1958) was used for measuring the adhesion of a modified mortar to old mortar. Ordinary mortar was first prepared and tensile briquets were made from this and allowed to cure for 14 days or more. The mortar had a water/cement ratio of 0.45 and briquets made from it were cut in half through the one square inch cross-section with a band saw. The exposed surface was wiped free of dirt on each briquet.

The damp half-briquet of ordinary mortar was placed in the mold. The mold was then filled with a latex-modified mortar and the samples allowed to remain in the molds for 24 hours. After curing for seven and 28 days at 65 per cent relative humidity and 70°F., the samples were tested dry on the Baldwin in the manner of concrete briquets for tensile strength. Other similar samples were cured in a water bath and tested in the same manner.

Shrinkage—Specimens measuring 11.22" by 2" by 2", identical to those used in the ASTM flexural strength test, were prepared. For this test, after molds are packed they are allowed to remain intact for 24 hours. This is enough time to allow the initial cure to take hold and thus prevent breakage or distortion when they are removed from the molds.

The mortar sample is held in a vertical position by a cylindrical column approximately one inch longer than the sample itself. A platform micrometer calibrated in thousandths of inches and capable of reading depth measurements is first zeroed on the glass plate which holds the apparatus. Then the initial reading is taken and recorded. The amount of shrinkage (based on the greatest linear dimension) is the evident difference between the first and the last readings. The final set with latex-modified mortar should be reached in approximately fourteen days.

Admixture Tested

Geon 450X17 latex was first tested as an admixture in a typical Portland cement mortar. The specific formulation (which includes a 3/1 cement/sand ratio) for duplication of this work was given in the preceding section. The use of Geon 450X17 as a mortar admixture is demonstrated with the data in this section.

Plain, unmodified mortars were used as control specimens in this work. The tensile strength and bond strength of unmodified Portland cement mortars are demonstrated in Figure 5. The effect of variable water/cement ratio is demonstrated and the plasticity of the mix appears to affect the adhesion to the bricks. The range of definite workability in unmodified mortars is severely limited as seen in Figure 5.

The tensile strength and the bond strength of latex-modified mortars are given in Figures 6 and 7. Identical determinations using a butadiene-styrene latex and a polyvinyl acetate latex are also given. The data on wet-cure strength demonstrate the advantage of Geon 450X-17 as a mortar admixture.

The patched half-briquet method of measuring adhesion shows the characteristic adhesive quality given to a mortar by the various latex types under wet and dry conditions (see Figure 8). Note again the wet-cure strength of Geon 450X17. This test is essentially tensile in nature. It is evident that the polyvinyl acetate is superior in dry cure. Since the unmodified half-briquets were wet-cured, the breakage during testing of the patched briquets occurred at the interface of the two mortars. This area of breakage was the square inch cross-section which is the normal breaking point in tensile testing.

Data are given in Figure 9 which show the relative shrinkage of various latex-modified mortars. All latex-modified mortars tend to contract considerably more upon drying and curing than ordinary mortars. Since water-cement ratios are in-

Figure 7—Bond Strengths of Various Types of Latex-Modified Mortars

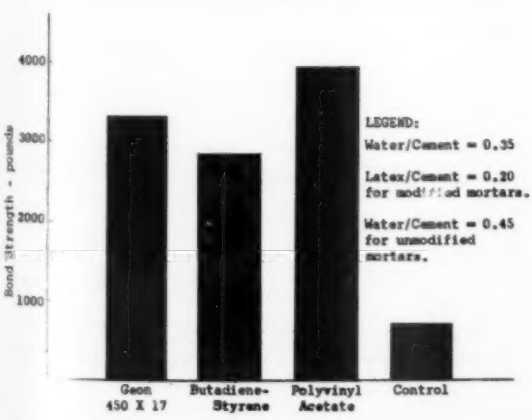


Figure 8—Adhesion Measured by Patched Briquet Method for Latex-Modified Mortars

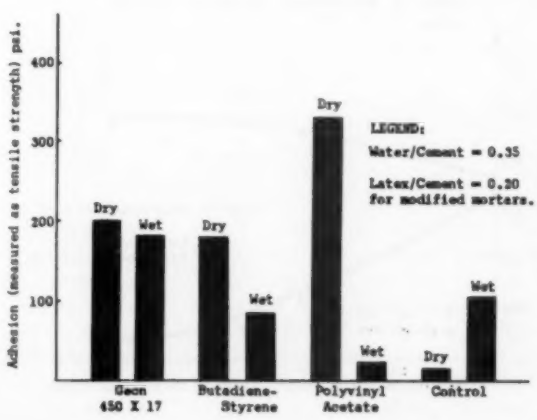


Figure 9—Shrinkage of Latex-Modified Mortar Specimens

Latex	Micrometer Readings—Inches Initial	Final	Shrinkage Inches	Per Cent Change
Geon 450X17	0.5530	0.5685	0.0155	0.138
Butadiene/Styrene	0.5470	0.5723	0.0253	0.225
Polyvinyl Acetate	0.5432	0.5758	0.0326	0.290
Control	0.5615	0.5671	0.0056	0.049

Notes: Cures were effected at 70°F. and 65° R.H. The original length of samples was 11.220. The water/cement ratio was 0.35. The latex/cement ratio was 0.20.

ordinately high in the unmodified mixes, then initial shrinkage is probably less because drying does not occur rapidly. However, the internal adhesion seems to be so great in latex-modified mixes that surface cracking does not occur.

Blending Geon 450X17 with a polyvinyl acetate latex and using as an admixture for Portland cement mortar gives the expected relationship as shown in Figure 10.

The ability to prepare a lightweight construction concrete, *i.e.*, thinner sections with strengths comparable to ordinary sections of standard thicknesses may be a likely possibility with latex-modified concretes.

Use of Data

However, there is some concern over whether or not the data obtained in a mortar system is translatable to a concrete system. It may be that by adding a larger aggregate, the entire system may be changed. A more realistic approach is to believe that a larger aggregate will only serve to strengthen the system—the strengths of most rocks being greater than that of Portland cement systems. Figures 11, 12 and 13 show the results when Geon 450X17 was used as an admixture in concrete.

The formulation used for concrete in this work is based on the maximum strength ratio of dry materials.[10] The ratio is 1.0/1.8/3.5—Portland cement/Ottawa sand/crushed limestone. No. 6 crushed limestone (0.25" average pieces) was used. Control samples (unmodified) were prepared at 0.50 water/cement ratio. Latex was added at levels ranging from 0.00 to 0.20 latex/cement. In the addition of latices, 0.30 and 0.45 water/cement ratios were used. However, Geon 450X17 provides a workable mix at water/cement ratios as low as 0.25.

From Figures 11, 12 and 13 it is obvious there is a genuine over-all improvement above that of ordinary concrete for latex/cement ratios in the range 0.11-0.20. The unmodified concrete control samples are high in flexural and tensile strength and especially high in compression strength.

The excellent compression strength of plain concrete has always been difficult to improve upon. The differences in strength characteristics between modified and ordinary concretes are not as broad as those existing between modified and ordinary mortars. This may be attributed to the effect of the larger aggregate.

Although no bond test was performed on concrete samples, it has been found to be approximately 40 per cent of the ultimate compression strength.[11] This theory was reported in conjunction with ordinary concretes and does not seem applicable to modified mixes. However, all indications point toward excellent bond strengths.

ASTM Bond Test

The bond test for concrete is listed (ASTM C-234-54 — Standards, 1956) as the test for bond between the concrete and an imbedded steel rod because of the wide use of steel reinforced concretes. An actual comparative test of this type was not conducted, but bond strengths between modified cements and steel are so strong that it is almost impossible to remove dried modified cement from working tools, while dried unmodified cements may be removed easily.

Figure 10—Effect of Blending Geon 450X17 with a Polyvinyl Acetate Latex

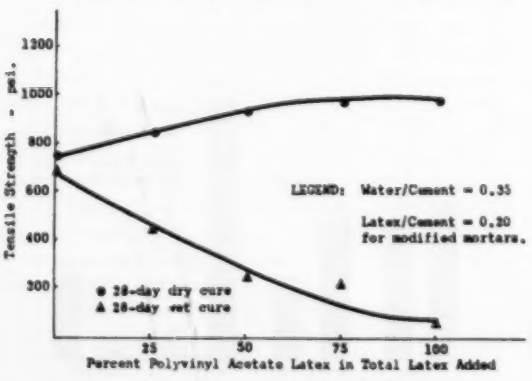


Figure 11—Tensile Strength Vs Latex/Cement Ratios for Geon 450X17 Modified Concrete

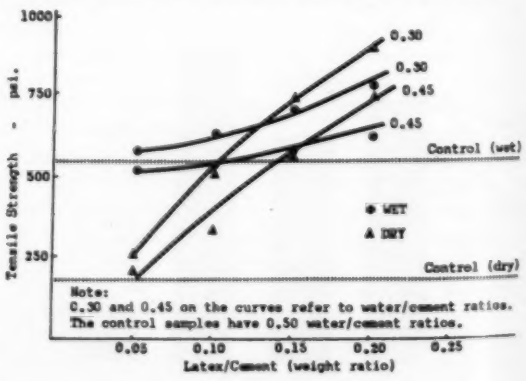


Figure 12—Flexural Strength Vs Latex/Cement Ratios for Geon 450X17 Modified Concrete

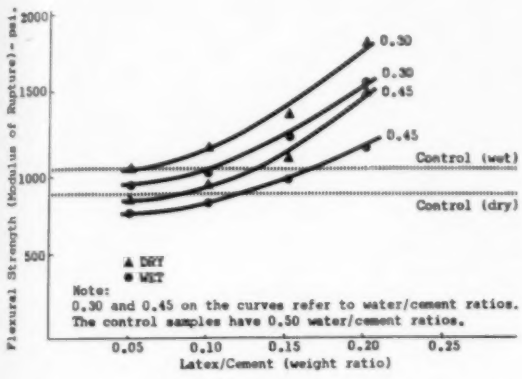
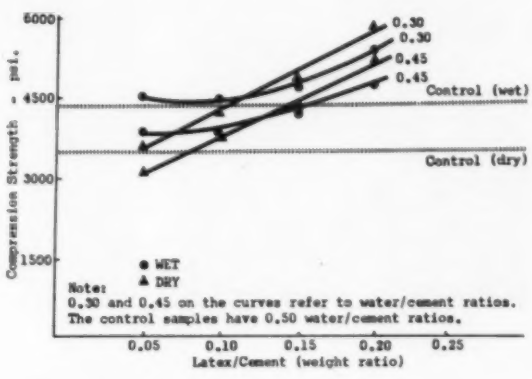


Figure 13—Compression Strength Vs Latex/Cement Ratios for Geon 450X17 Modified Concrete



The torsional modulus of rupture is predicted at being slightly less than the flexural modulus of rupture. Since flexural strength increases, it may be assumed that torsional strength does also. The coefficient of thermal expansion is probably little changed by the addition of latex.

Extending Ideas

The following application ideas are presented as a logical extension of the improved mortar and concrete:

Improved Mortars as Adhesives— A formulation was developed as an adhesive medium between various substances and concrete or ceramic surfaces. It has performed particularly well with vinyl asbestos floor tile, ceramic tile and mosaic tile. The formulation when used in a layer 1/16" thick provided excellent adhesive qualities. The Geon 970X-11 mentioned in the formula for flooring adhesive given below is a vinyl acetate homopolymer made by B. F. Goodrich Chemical Co.

Flooring Adhesive

	Wet Parts by Weight
White Portland cement	210
Geon 450X17	25
Geon 970X11	25
Water	25
Glycerine	4-5

The same mixture can also be used as a pointing compound and works especially well in applications with ceramic tile. The passage of water from the mixture to the porous edge of the tile is evidently retarded, which results in an excellent, strong adhesive joint.

Patching and Resurfacing — Spalled areas, like the one shown in Figure 14, can be economically resurfaced with a thin, strong coat of a Geon 450X17 based mortar. The spalled surface was created when a heavy piece of equipment was removed from the concrete floor, leaving a rough scarred area 1/8"-1/2" below the average floor level.

Simple surface preparation consisted of sweeping the area clean with a damp broom. The following formula was then applied with the results shown in Figure 15.

Patching Formula

	Wet Parts by Weight
Ottawa Sand	300
Portland Cement	100
Geon 450X17 (0.20 latex/cement)	40
Water (0.35 latex/cement)	15

This patched area has been subjected to heavy punishment from foot traffic and the scraping and pushing action of office chairs which often subject the coating to pressures of 40-80 psi. Adhesion is excellent and no failures of any kind have occurred even though the surface is less than 1/8" thick in some places. This resurfacing has given two years of service whereas ordinary mortar would have failed very soon after application.

Fillers for Masonry Blocks — The ordinary concrete cinder block or concrete masonry unit has a very porous surface which usually contains large, irregular voids. Sealing these surfaces with a paint or decorative coating is usually quite expensive since multiple coats are needed.

Filler Formulation

A filler formulation was developed to be brushed into the surface of the block prior to the application of paint.

Cement Block Filler

	Wet Parts by Weight
White Portland Cement	16.5
Aggregate (Ottawa sand)	33.5
Geon 450X17	7.2
Water	16.8
Masonry paint	11.3

The water content and masonry paint content may be varied to provide the desired consistency. paint content of the formulation provides better covering power for the filler. The masonry paint is based on Geon 450X3, a companion latex of Geon 450X17 having better paint properties.

For all but the most pitted walls, a single coat of block filler compound will effectively smooth the

Figure 14—Spalled Area

Figure 15—Patched Area

surface while halting excessive penetration of subsequent paint coats. Adhesion remains firm, even under severe basement moisture conditions. The cost of applying block filler plus paint usually runs at least 1/3 less than if paint alone were used.

Improved Portland Cement-Based Paints — A typical Portland cement water base paint adheres to a cement or masonry wall by combining with the unreacted calcium oxide in the old concrete and effecting slow hydrolysis reactions akin to those in normal concrete curing. Chief advantages of these systems are low cost and relatively long life. The chief disadvantage is that they must be applied in thick sections. Once they begin to fail, such a thick cross section of spalled, porous cement is formed that the surface cannot be recoated. It must then be removed at considerable expense.

Improves Adhesion

Adding Geon 450X17 to such a pigmented cement base improves adhesion (curing) and covering power, allowing a thinner coat to be applied with no loss in initial properties or appearance. No conclusive data on long term aging is yet available. It is thought, however, that even if the surfaces eventually failed, the thin coating would offer fewer problems in preparation for recoating than materials now used.

A typical formula used in testing is given below.

Modified Portland Cement Paint

	Wet Parts by Weight
Paint Pigment	100
Water	58
Geon 450X17	
50% total solids	30

The Portland cement base paint pigment used was a standard commercial type. Water was added to dissolve the color pigment and the latex was slowly stirred in. Additional dilution for consistency should be done with latex at 15-20 per cent total solids.

Chemical Resistance—The chemical resistance of mortar depends greatly on its water resistance. The results in Figure 16 indicate the degree of protection which Geon 450X17 provides to mortars when it is added to mortar mixtures or coated on previously cured samples. The chemical resistance of this test was measured as the gain or loss in weight of 85/15 Portland cement/asbestos fiber mortars. Asbestos fiber was chosen as a material least likely to be attacked by chemicals thus giving a true picture of the chemical resistance of the cement and the protective power of the latex.

For mixing procedures in laboratory evaluations, the Hobart mixer-agitator — made by Hobart Mfg. Co., Troy, Ohio—was employed at low speed in batch sizes of approximately 4000 grams. Hand mixing was done in the same manner as with ordinary, unmodified mortars and concrete.

The dry ingredients were thoroughly blended before the addition of the liquid constituents. An exact water/cement ratio was maintained by first taking into account the water content of the latex. In actual practice, the Geon 450X17 latex may be diluted a little more than half its original total solids and added to the dry ingredients until the desired consistency is obtained. Care should always be taken to ensure that a homogeneous mixture results. Slow speed mixing should be used in order to prevent foaming and air entrapment.

Preparing a latex/Portland cement mixture is not difficult. If the sand is wet, then the latex should be added undiluted to the Portland cement/aggregate mixture. Thorough mixing should follow to determine if the consistency is satisfactory before additional water is added. If the latex is first diluted and then added to the wet sand, the water in the sand may produce a high water/cement ratio.

The addition of a latex, particularly one of the plastomeric variety, usually lowers the amount of water needed for proper flow. The modified mixture is very plastic. Laboratory experience shows that workable mixes result from 0.25-0.35 water/cement ratios whereas ordinary unmodified mixes at water/cement ratios of 0.45 to 0.55 would hardly appear wet.

Latex-modified cement mixes can not be hard trowelled. They exhibit wet drag on the trowel and set up rapidly, forming a surface film

Figure 16—Chemical Resistance of Modified and Unmodified Mortars

Sample Immersion Hours	*% Loss or Gain in Weight*
NaOH—4 normal	
plain	+11.8
latex-modified	+ 7.5
latex-coated, plain	+ 2.3
HCl—concentrated	
plain	– 5.3
latex-modified	– 0.32
latex-coated, plain	– 0.63
HNO_3—concentrated	
plain	– 9.9
latex-modified	– 0.19
latex-coated, plain	– 3.6

which will tear upon hard troweling. Within a normal temperature range (similar to that for unmodified mixes) the modified mix need not be covered with wetted sacks and does not require occasional sprinkling to prevent surface cracking.

Smoother surfaces can be obtained by dipping the trowel or brush in diluted latex and retempering the surface. This does not, however, permit hard troweling.

Problems Cut

There is good evidence that the vinyl chloride copolymer latices, represented in this article by Geon 450X17, considerably diminish the outdoor durability problems now associated with latex modified cements. Exciting new applications that may now be possible are—lightweight roof decks; thin, easy to apply terrazzo coatings; and full strength adhesives for outdoor tile work.

With every indication that highly water resistant modified cements are now possible, it is hoped that vinyl copolymer latices have truly added a new dimension to the field of polymer additives for Portland cements.

Literature References

(1) Construction Equipment Magazine, August, 1960, p. 75.
(2) U.S. Patent No. 2,820,713, H. B. Wagner, January, 1958.
(3) Stevens, W. H., Rubber Developments, Vol. 1, No. 1, pp. 19-27 (1947).
(4) Griffiths, L. H., Chemistry and Industry, September 20, 1947, pp. 578-580.
(5) Griffiths, L. H., The India-Rubber Journal, February 23, 1952, pp. 304-307.
(6) van Gils, G. E., and Clarkson, H., The India-Rubber Journal, June 3, 1950, pp. 773-777.
(7) Geist, J. M., Amagna, S. V., and Mellar, B. B., Industrial and Engineering Chemistry, Vol. 45, No. 4, April, 1953, p. 759.
(8) Corps of Engineers (Vicksburg, Mississippi), "Review of Available Information on Polyvinyl Acetate as an Admixture for Concrete," Tech. Report, No.-6-486, July 1958.
(9) U.S. Patent 2,819,239—"Portland Cement — Vinylidene Chloride Polymer Composition, Method of Making, and Method of Using"—Eberhard, J. F. and Park, A.—January 7, 1958.
(10) American Concrete Institute, Concrete Manual, 1957.
(11) Kirk and Othmer, "Encyclopedia of Chemical Technology," Vol. 3, Interscience Publishers, Inc.

Bonded Teflon Helps Solve a Sticky Problem

If nothing will stick to it, how can you bond it to anything?

This was the problem that confronted Richardson Scale Co., Clifton, N.J., one of the world's largest producers of weighing, bagging and proportioning equipment. Richardson was making a study of how sticky materials such as molasses-feed could be weighed without the problem of scale-clogging or frequent and time-consuming cleaning operations.

The obvious answer was to line the scales with Teflon, a fluorocarbon with a low coefficient of friction and unusual non-adhesive characteristics. But how do you attach a material whose biggest selling point is that it won't stick to anything?

At first, Richardson tried bolting the Teflon to the metal surfaces of the scale. It was soon found, however, that sticky materials accumulated around the bolt heads.

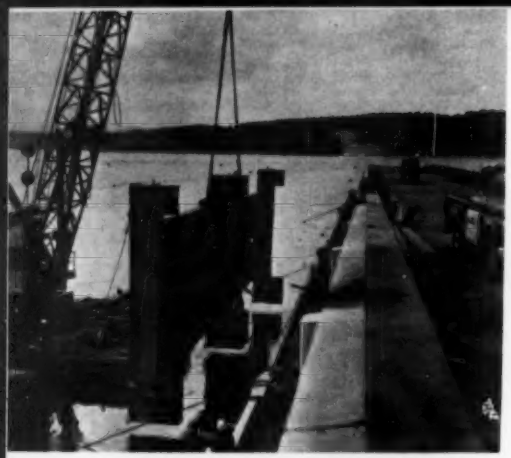
At this point Richardson consulted Raybestos-Manhattan, Manheim, Penna., one of the earliest fabricators of tetrafluoroethylene resin. R-M engineers recommended a system in which treated Teflon in three-foot squares, 1/16-inch thick, are cut to size and shape and bonded to the scales with specially formulated R-M adhesives. The secret of the process is that one side of each Teflon sheet is etched to provide a bonding surface.

An automatic molasses-feed scale made by this process is currently being used at Beacon Milling Co., Cayuga, N.Y., and estimates are that annual savings due to speedier production and the elimination of stoppages due to scale clogging run in the neighborhood of $6500 to $7000.

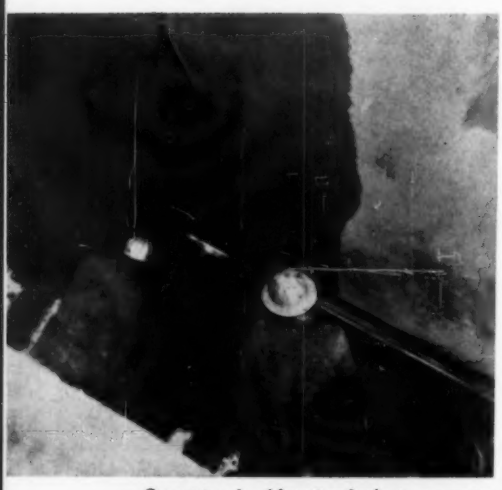
Before the use of Teflon linings, the interior surfaces of scales at Beacon Milling had to be scraped clean a minimum of two times a day.

Scales lined with Teflon can be wiped clean with only a damp sponge. Clogging has been eliminated and cleaning time has been cut 90 per cent.

Epoxy Grout Compound Bonds Pontoon Sections of Floating Bridge



Temporary strongback is eased into position. One on each side of the joint provides rigidity while epoxy is poured.



Concrete is blow-torched to remove moisture. A rubber gasket is then bonded in place to seal the bottom and sides.

Epoxy grout is poured into v-shaped hoppers which straddle the joint. Notice good flowability of compound.

A unique adhesive application is playing a strong role in the reconstruction of the Hood Canal Bridge, a floating structure which spans the Duwamish River to the Kitsap Peninsula in western Washington state.

The bridge consists of 23 concrete pontoons, each 360 feet long. These support an elevated roadway which is 20 feet above the water—out of the way of salt spray and wave splash. One section is designed to be winched into an open position to permit passage of large vessels.

In 1959, the bridge suffered extensive damage in a series of severe storms with winds up to 50 miles per hour. As a result, a strengthening and repair contract was awarded Yuba Erectors, San Francisco, Calif.

The joints between the pontoons are brought together to form a 1½-inch gap which is sealed on the bottom and sides by a rubber gasket. Each gasket is bonded in place by an epoxy adhesive. Joints are 50 feet wide and 14 feet high.

After the gasket is in place, another epoxy adhesive is blended with light gravel to make a flowable grout which is then poured into the pre-heated joint. Once cured, this high strength adhesive produces a bond which is actually stronger than the concrete it has joined. Known as Concresive #17, the epoxy is a product of Adhesive Engineering, San Carlos, California, a division of Hiller Aircraft Corp.

Charles S. Nichols, engineer of toll facilities for the State Toll Bridge Authority, said tests have shown that the structure will fail elsewhere before the epoxy gives way. He also stated that the adhesive application is one of the largest of its type on record. It is estimated that over 8000 gallons of the epoxy formulation will be used by the time the bridge over the Duwamish is completed.

To facilitate set-up times, the unmixed adhesive is heated in drums. The light gravel used as a grout is also heated in a revolving hopper as it passes an exposed blow torch, and the joint itself is laced with heating elements for 24 hours prior to a pour.

Five mixing stations are used and compressed air driven paddles thoroughly blend the two components of the epoxy with the gravel. Mixing is done in five-gallon pails and these are poured into v-shaped hoppers which straddled the joint. A total of about 25 men are involved in each pour and from 1½ to 2½ hours are required. Between eight to ten drums of adhesive are used in each joint.

Use Strongbacks

Thirty-ton steel strongbacks on each side of the joint are used to hold it rigid while the epoxy grout formulation is being poured. The strongbacks have integrally built-in worm gears which exert a 20-ton clamping pressure on the bottoms and decks of the pontoons. They are laced under the pontoon and across the decks with steel cable and turnbuckles. Once the joint is cured, the strongbacks are removed.

The critical role that the epoxy formulation plays in this reconstruction is emphasized by the extremely strong currents of the canal plus tides which rise to 17 feet at the worst times of the year. Water depths are still another factor. There are fixed roller connections at the anchorages as well as a transition span to accommodate the rise and fall of the tides and each anchorage consists of 550-ton concrete boxes.

NEWS of the

ADHESIVES WORLD

ASTM Committee C-24 on Joint Sealants Meets in Atlantic City

ASTM Committee C-24 on Joint Sealants and its three subcommittees met on June 27, 1961 at the Chalfonte-Haddon Hall in Atlantic City, N.J., during the 64th Annual Meeting of the American Society for Testing Materials. H. Kleinhans (Luce-Reflexite), membership secretary, reported that C-24 consists of 95 members, of whom 80 are voting members. The membership is classified as follows: 33 producers, 27 consumers, 20 general interest, and 15 consultants.

Wayne Koppes (consultant), chairman of C-24, reported on a discussion that took place at the Executive Committee meeting. He stated that it is believed that there is a desire on the part of some C-24 members to become active in developing tests on sealants and bulk compounds based on various elastomeric polymers. In determining the extent of this varied interest, it was felt that a poll should be made of the entire C-24 mailing list, as well as some of the basic polymer manufacturers, in order to determine the extent of this interest.

According to Mr. Koppes, should any genuine interest be found, then it is the intent of the Executive Committee to review the poll and set up specific task groups to study and propose tests around specific polymer types. Such work could be integrated into the proper subcommittee or might be assigned to a new subcommittee.

Mr. Koppes pointed out that the Executive Committee is aware of the fact that present activity of Subcommittee 2 on Bulk Compounds is centered around polysulfide base sealants. This is partly due to the fact that the subcommittee is now responsible for future revisions of ASA Specification 116-1, and that much of the work is based on reviewing and improving test methods in this specification which should be applicable to other elastomeric sealants. According to the C-24 chairman, it is with this knowledge that the Executive Committee felt that additional task groups could now be organized.

The subcommittee reports follow:

Subcommittee 1 on Nomenclature —Henry Lipkind (Avadan Corp.), chairman: Subcommittee 1 will continue to maintain liaison with Subcommittees 2 and 3. Mr. Lipkind will represent C-24 on ASTM Committee E-11 on Quality Control of Materials. This pattern of liaison will enable Subcommittee 1 to maintain complete contact with C-24 as well as over-all ASTM on interlaboratory testing and definition of terms.

To crystallize the needs of C-24, agreement was reached on restricting the activities of the subcommittee to the terms used in ASA Specification 116.1 and to the program of Subcommittees 2 and 3 task

Members of ASTM Committee C-24 on Joint Sealants hear R. H. McKinley (Pittsburgh Plate Glass), standing, chairman of Subcommittee 3 on Preformed Shapes, present a report on the subcommittee's activities, during the committee's annual meeting. Seated, left to right, facing the group, are J. R. Panek (Thiokol), C-24 secretary, and Wayne Koppes (consultant), C-24 chairman.

THIS IS DU PONT "ELVAX"...

"ELVAX" vinyl resins are translucent, free-flowing pellets that blend readily with wax to form strong, flexible coatings for a wide variety of packaging materials. "Elvax" blends are easy to apply by hot-roll, curtain or solvent-coating techniques.

a new vinyl resin that gives wax greater versatility in packaging

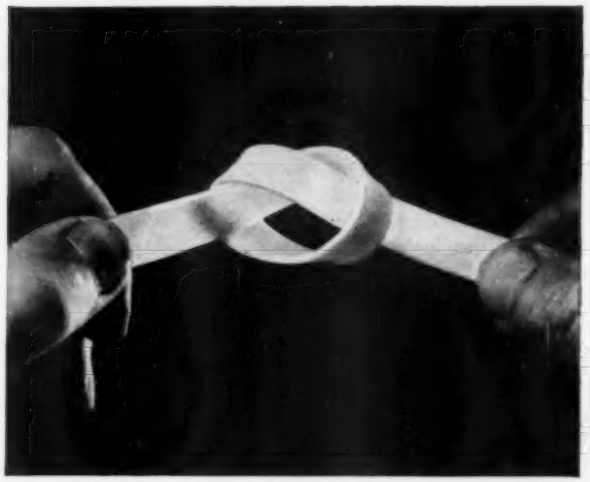
"Elvax" is a new, high-molecular-weight vinyl resin that makes possible low-cost wax coatings of superior adhesion, flexibility and toughness with excellent water-barrier properties.

With "Elvax" you can, for the first time, control the water-vapor transmission rate (WVTR) of wax coatings simply by varying the ratio of "Elvax" to wax. As little as 5% of "Elvax" added to wax reduces the creased WVTR of unmodified wax coatings by 50% without impairing the flat WVTR. In addition, resistance to grease penetration is improved significantly. When 40% "Elvax" is blended with wax, flexible 1-mil coatings with flat and creased WVTRs of 0.2-0.4 gms./100 in.^{2}/24 hours are obtainable.

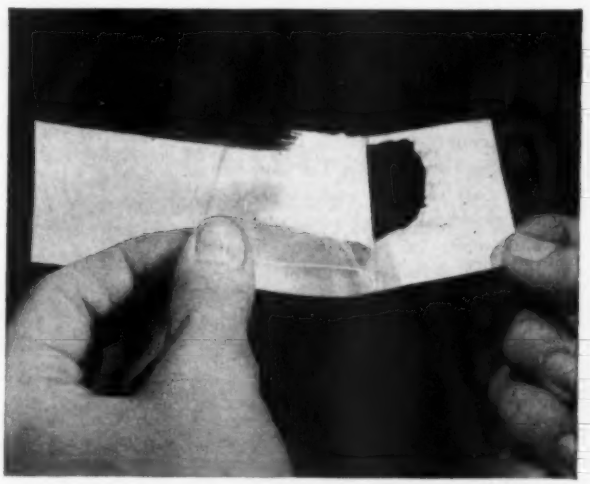
You can obtain tough, flexible adhesive bonds using "Elvax" alone or combining it with waxes, resins, rosins and rosin derivatives. "Elvax" exhibits strong adhesion because of the chemically active polar groups in its molecules. Flexibility and toughness (see upper right) result from its rubber-like, noncrystalline structure and high molecular weight. Hot-melt, solvent and pressure-sensitive adhesives based on "Elvax" adhere tightly to all films used in packaging today (see right).

Since "Elvax" will be used in food packaging applications, Du Pont is currently completing a nineteen-month study which will be used to petition the FDA for permission to use "Elvax" where contact with food is concerned.

You can order "Elvax" now in commercial or evaluation quantities. Our new booklet on "Elvax" provides information on properties and application methods . . . suggests possible uses. Write: Du Pont, Electrochemicals Dept., Vinyl Products Division, Room N-2534, Wilmington 98, Delaware.



FLEXIBILITY is demonstrated by tying a strip of paraffin wax, blended with 40% "Elvax", into a knot. When "Elvax" is added, the strip becomes plastic...will take 50% elongation before it breaks . . . is flexible at –20°F.



ADHESIVE STRENGTH of wax extended with 40% "Elvax" is shown by the fiber-tearing bond obtained when paper coated with "Elvax"/wax is heat-sealed to polyethylene. Coatings based on "Elvax" heat-seal to all films used in packaging today.

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

"ELVAX"
VINYL RESINS

groups. A bibliography of sources for terms and definitions will be assembled and distributed to the membership of Subcommittee 1. Each member will present definitions on 5 or 6 terms taken from ASA 116.1 and/or Subcommittees 2 and 3 task group presentations. A modification of a Construction Specification Institute form will be adapted by the subcommittee for a word definition work sheet.

Subcommittee 2 on Bulk Compounds — Frank Frybergh (Skidmore, Owings, & Merill), chairman: The specification or test method on staining as outlined by Arthur Hockman (National Bureau of Standards) was discussed, as well as the modifications in the methods presented in ASA Specification 116.1. It was concluded that a method to determine the degree of staining or the intensity of same must be determined, in order to tell whether a border line case is present or how prevalent the stain or discoloration is. Another series of round robin tests will be conducted, with an attempt to set conditions such as deionized water to be used, types of weatherometers, number of hours, and a control sample without sealant.

Presents General Report

Boris Pozniak (Percora) presented a general report on the activity of Task Group A on Tests of Adhesion in Tension and Accelerated Aging. Mr. Pozniak requested more volunteers to participate in outlining a definite program for testing. The test program of Task Group B on Test of Application Rate, Flow and Rheology was outlined. It was suggested to specify the type of metal to be used in the channel for the slump test.

Mr. Hockman reported that an interim Federal specification on polysulfide type sealants will be issued shortly. R. J. Schutz (Sika) will serve as liaison between Subcommittees 1 and 3.

Subcommittee 3 on Preformed Shapes—R. H. McKinley (Pittsburgh Plate Glass), chairman: C. B. Monk (Structural Clay Products Research Association) discussed end use requirements for joint gaskets. He presented some numerical rating requirements for such properties as modulus of elasticity, tear and adhesive strength, rigidity, fatigue resistance, and compression set. Task Group A, doing this work, will continue its study of these numerical ratings, giving consideration to the points brought out in the general discussion of the problem.

R. H. Barton (DuPont) presented a specification for a neoprene 70 Durometer A hard zipper gasket and an 80 Durometer A hard filler strip. H. R. Brown (D. S. Brown Co.) discussed the reasons for the property requirements in his company's specification for neoprene closed cell expanded sponge. D. E. Jackson (Butler Mfg.) presented a guide for preparing specifications.

Develops Durane Finishes

Raffi and Swanson, Inc., Wilmington, Mass., has developed a new series of chemically reacted finishes called Durane. Polyurethanes, epoxies, and polyesters are among the new polymers used in these formulations. The company states that they offer superior durability, toughness, flexibility, and resistance to chemicals and corrosion. In many cases, these properties can be obtained with a room temperature cure. Durane coatings are recommended for a variety of end uses. Specific formulations that can be applied with most types of standard equipment have been developed for metal, wood, fabric, and paper.

"According to my calculations, gentlemen, this machine is not only sifting, liquidizing, bottling and labeling your adhesives—it's also eating them."

Markets Repair Materials

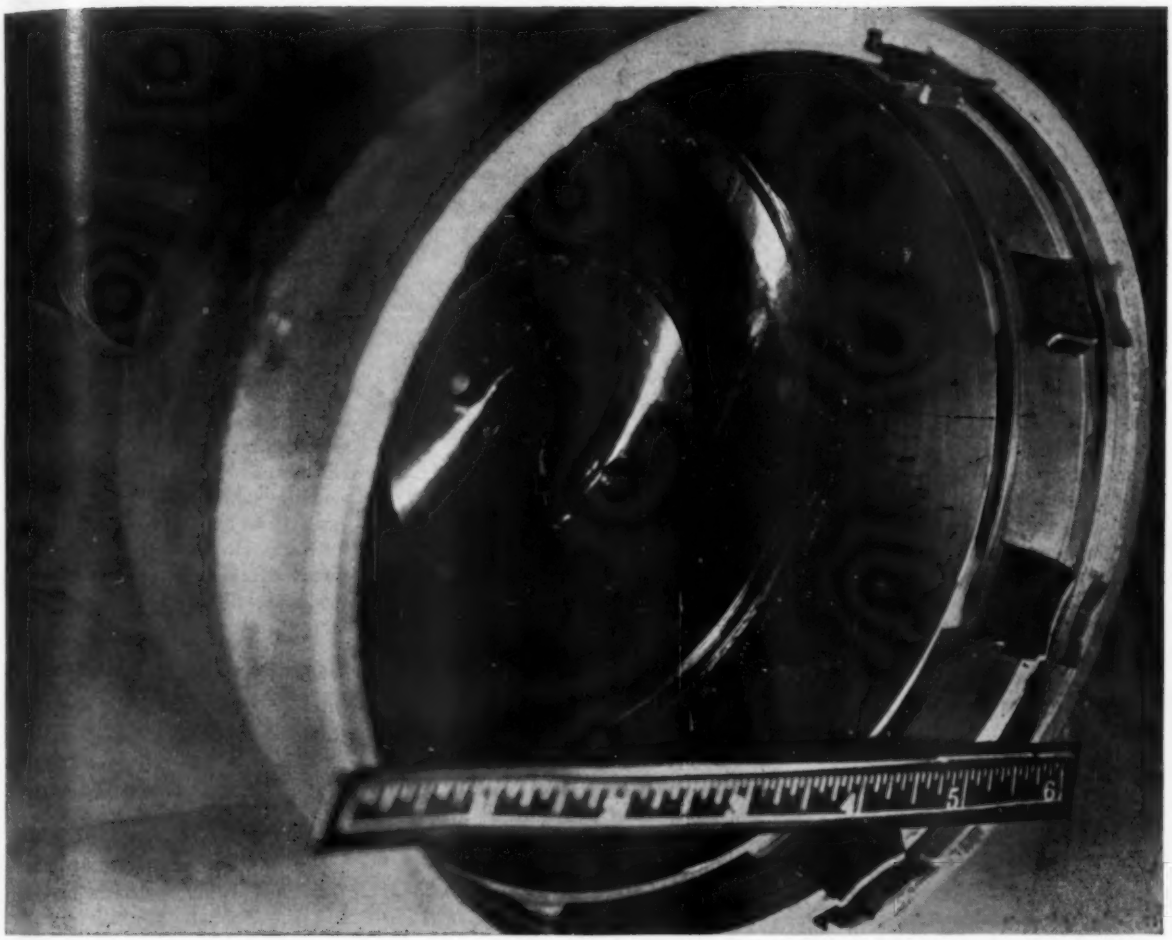
Revere Chemical Corp., Cleveland, Ohio has developed a new team of plastic floor repair products, Kwik-Set and Crack-Fix, which can be used together to rebuild a floor surface, or individually for specific floor repair problems. According to Revere, they will not pit or scar and will withstand the heaviest industrial loads. Being compression products, Kwik-Set and Crack-Fix, which can harder and smoother as traffic rolls over the repaired areas. Kwik-Set, a granular plastic material, is used to repair worn or rutted areas in concrete or wood surfaces, and to resurface the entire floor area. Revere Crack-Fix, a fine granulated plastic, is used to repair cracks, expansion joints and shallow holes in interior and exterior concrete and wood floor surfaces. Both products are supplied in ready-to-use form.

Airco Names Manninen

Dr. Thomas H. Manninen has been appointed technical assistant to the president of the Air Reduction Chemical & Carbide Co., New York, N.Y. As an advisor to G. R. Milne, president of Airco Chemical & Carbide, Dr. Manninen will be responsible for reviewing and evaluating plans for new plants, plant expansions, and plant improvements. A graduate of Antioch College, Dr. Manninen received his Ph.D. degree in physical chemistry from Columbia University. With Airco since 1954, he formerly was director of chemical research and engineering at the central research laboratories of Air Reduction Co.

Hughson Develops Paste

A new combination cleaner and chemical surface treatment for aluminum is available for evaluation testing from the Hughson Chemical Co., Erie, Penna. Designated as EX-B727-6, the translucent, organic paste is applied by spraying, brushing, or wiping. When the dried paste is rinsed off, the manufacturer reports, the surface is left with exceptional adhesive properties for bonding or coating. The company states that the paste also serves as a surface cleaner for stainless steel and chrome-plated surfaces.



CYCLEWELD CHEMICAL PRODUCTS DIVISION, CHRYSLER CORPORATION

SEE WHAT RUBBER-BASE ADHESIVE CAN DO?

This is the housing of an automotive torque converter. It's joined to the output shaft by a thin film of thermoset cement.

The converter has just undergone torsional tests that wrecked its mechanical parts—with no effect whatever on the metal-to-metal bond. This bonding job is an achievement of Cycleweld Chemical Products Division of Chrysler Corporation.

A similar cement, made of nitrile rubber and Durez® phenolic resin, cut the cost of assembling an all-aluminum truck tailgate by eliminating 211 rivets and 42 welds.

Other heat-setting cements that marry rubber and phenolic resin show promise for:

- building new strength and quietness into car doors, deck lids, and hoods by edge-bonding instead of tack welding.
- attaching metal trim without drilling holes.
- easy-to-cast aluminum engine heads and intake manifolds, made in *two* sections bonded together with a leakproof, heatproof seal.

If you have a tougher-than-usual bonding problem—or expect to have one—now's the time to see what a rubber-phenolic adhesive can do for you. We'll be glad to put you in touch with people who make such adhesives.

We don't make these adhesives. We just supply some of the basic ingredients—phenolic resins that influence the qualities a good structural adhesive must have. Permanent, rigid set. Controlled tack. Heat resistance. Precise sameness from batch to batch. Good storage stability. Many superstrong adhesives are the result of teamwork between rubber chemists and Durez resin chemists backed by 40 years of experience.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 8509 WALCK RD., NORTH TONAWANDA, N. Y.

HOOKER CHEMICALS PLASTICS

Armour Offers Plant

A new industrial processing plant located in Philadelphia, Penna., is being made available to industry by Armour Alliance Industries, Alliance, Ohio, for the custom mixing and blending of various non-food liquids and granular materials. The new plant is presently in operation producing a limited line of Armour chemicals. According to a company spokesman, the excess capacity of the plant offers companies throughout the country an opportunity to produce or test various types of blended products for the East Coast market without the necessity of a capital investment or the risk of continuous plant overhead required in seasonal slack times or during the critical market introduction period. Armour states that the availability of this facility places it squarely in the industrial processing business and opens up a completely new marketing opportunity for many firms that cannot justify an East Coast plant.

Coating Extends Roof Line

A new roof coating for maintenance of asphalt shingle and asphalt rool roofs is being marketed by Schwartz Chemical Co., Inc., Long Island City, N.Y. Called M-6371, the new coating is reported to increase heat reflectance and extend water-proof life of the roof as much as 15 years. M-6371 consists of a synthetic rubber base with colored aluminum pigment, applied by means of a coarse brush or roller coater. Preparation for the coating consists of sweeping the roof surface free of loose gravel, debris, and mold.

National Sales Up

National Starch & Chemical Corp., New York, N.Y., reports that its net sales for the first six months of 1961 totaled $32,759,561, compared with $30,545,665 in the same period of 1960. Net income after taxes for the six month period ended June 30 was $1,875,143, equal to common share earnings of 88¢ compared with the 1960 first-half figure of $1,670,043, or 79¢ per share.

Dr. C. W. Walton

3M Research Head

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has appointed Dr. Charles W. Walton as vice-president for research. Dr. Walton, formerly vice-president and general manager of the Adhesives, Coatings and Sealers Division of 3M, succeeds Dr. Carl Barnes, who recently resigned from the company for personal reasons. In his new assignment, Dr. Walton will be responsible for the Central Research Laboratory and the Products Fabrication Laboratory. He also will be responsible for relating activities of staff laboratories with those of division laboratories.

Dr. Walton's career in research extends back to 1928 when he began work on a summer employment basis at the Wood River, Ill., laboratories of the Standard Oil Co. of Indiana while studying for his B.S. degree at the University of Illinois. He obtained his Masters degree and Doctorate in chemistry at the University of Michigan, attending under a DuPont fellowship.

In 1933, he joined the Goodyear Tire & Rubber Co. as a research chemist, and attained the post of chemical products manager of the development laboratory prior to joining 3M in 1947 as assistant to the executive vice-president. He subsequently served four years as manager of the New Products Division of 3M, and for the last eight years has been in charge of the Adhesives, Coatings and Sealers Division. He was named vice-president of the division in 1959.

Offers Polylabel Adhesive

A new, non-inflammable adhesive which reportedly bonds paper labels permanently to treated and untreated polyethylene containers has been developed by Java Latex & Chemical Corp., New York, N.Y. Called Polylabel Adhesive, the water-based compound can be applied by any of the standard labeling machines, and is designed for use on rigid, semi-rigid and flexible polyethylene containers. The company states that the adhesive is applied to the label, which is then brought immediately into contact with the container, thus eliminating the need for expensive silk screen printing and pressure-sensitive labels which must be separated from a release paper. The adhesive is also said to be fast grabbing, offers excellent aging qualities, and will not crystallize.

UCC Develops Antifoam

A new and improved antifoam fluid for industrial use has been developed by the Silicones Division of the Union Carbide Corp., New York, N.Y. Intended for use in a variety of manufacturing processes, the new product not only quells foam, according to Union Carbide, but is extremely effective in foam prevention. Most effective when added to the system before foaming starts, it can be used at full strength as supplied, in solvent dispersion, or in a blend containing one of the foaming compounds. The company states that the antifoam fluid reduces processing time and potential fire hazards, works well at high temperatures, and offers longer storage life and stability.

Hysol Gets Permacel Line

Hysol Corp., Olean, N.Y., has purchased from Permacel, New Brunswick, N.J., its epoxy electrical insulation potting and encapsulation product line. According to a joint announcement, the sale is limited to this line only. Hysol will manufacture and market these materials and will service the former Permacel customers. The sale became effective on August 1. Both companies will continue to produce and market their other traditional product lines.

General Mills Earnings

General Mills reported record sales and increased earnings for the fiscal year ended May 31. Earnings totaled $12,832,000, an 11.4 per cent increase over the $11,515,150 reported for the comparable period in 1959-1960. This was equal to $1.63 per share of common stock, compared with $1.46 last year. Sales reached $575,512,000, representing a 7 per cent increase over the $537,818,050 recorded in 1959-1960. Record dividends of $9,703,000 were paid to stockholders at the rate of $1.20 per share of common stock and the regular five per cent on preferred. The company reported that its chemical activities were a strong point during the year. Other factors said to have contributed to the higher sales and earnings were an improvement in consumer food activities, and expansion in overseas operations.

United Shoe Report

Consolidated net income for United Shoe Machinery Corp. for the fiscal year ended February 28 amounted to $10,487,161, compared with $10,780,268 for the preceding year. Included in net income are net gains of $4,161,508 resulting from sales of shoe machines outstanding under lease, as compared with similar gains of $2,889,917 for the previous year. After provision for preferred stock dividends, income was equal to $4.39 per share of common stock, compared with $4.52 per share for the fiscal year ended 1960. The company reported that volume of merchandise sales, excluding sales of machines outstanding under lease, amounted to $61,595,607, compared with $62,297,708 last year.

Army Approves TC-459

A flexible epoxy potting compound, TC-459, produced by Electronic Production & Development, Inc., Hawthorne, Calif., has been tested and approved by the Army Ordnance Department, and is now being shipped to missile launching sites throughout the country. TC-459 has been given Ordnance No. 8030-965 with nomenclature "Insulation Compound, Electrical Flexible" by ARGMA, Redstone Arsenal, Huntsville, Alabama.

EPOXY RESINS
Clarence has doubled his construction speed since he switched from rivets to rugged adhesives made with BAKELITE Epoxy Resins.

AN EXAGGERATION, you say? Certainly. But in one tough application after another, epoxies *are* replacing traditional fastening techniques.

Union Carbide offers you many different BAKELITE epoxies. Some are used in adhesive formulations that work well under water... in outer space... in the hottest oven or in arctic cold. Whatever your requirements, select an appropriate resin from Union Carbide's broad line of epoxy resins... phenolics and vinyls, too. Call on us when you're stuck... or, preferably, before you are! Write Dept. KD-1P, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Limited, Toronto 12.

UNION CARBIDE PLASTICS

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Develops Roof Coatings

A new process for homogenizing the ingredients in its liquid aluminum and liquid asphalt roof coatings has been developed by the Revere Chemical Corp., Cleveland, Ohio. The process suspends the asphalts and asbestos into the sealing oils, producing a smooth, viscous liquid which requires no mixing, heating or other preparatory steps. The company states that there is no separation or settling of waterproofing and insulating ingredients in the container or on the applied surface. According to Revere, these coatings assure even distribution of material in resurfacing jobs. The entire roof surface is resaturated, waterproofed and insulated with a continuous blanket of weatherproofing protection which will not harden, blister or crack. The coatings remain pliable and will expand and contract with the building.

Hysol Buys Epoxy Line

Hysol Corp., Olean, N. Y., has acquired the Permacel epoxy electrical insulation potting and encapsulation product line formerly produced by the Permacel Division of Johnson & Johnson, New Brunswick, N.J. The sale is limited to the Permacel epoxy potting and encapsulating line only. A joint statement by Hysol and Permacel reveals that Hysol will manufacture and market these materials henceforth and will service former Permacel customers. Both companies will continue to produce and market their other traditional product lines.

Develops Coating Resins

A series of polyurethane alkyds and coating resins which have been compounded to produce solvent solution coatings has been developed by the Commercial Resins Corp., St. Paul, Minn. The series, designated U-1000, is said to offer excellent properties for marine applications, exterior coatings, and for floors and masonry. It is a solvent solution of a one-can stable polyurethane modified alkyd resin, furnished at 60 per cent solids in mineral spirit. In addition, it dries by oxidation like a conventional alkyd and requires no catalyst.

OBITUARIES

Harry Peters

Harry Peters, metropolitan New York representative for Miracle Adhesives Corp., Bellmore, Long Island, N.Y., died suddenly on February 3 in New York City at the age of 58. A native of Brooklyn, N.Y., Mr. Peters completed his education at the Alexander Hamilton School in Brooklyn. In 1935, he joined the S. C. Johnson Co., leaving in 1939 to join the R. M. Hollingshead Corp. In 1942, after serving two years in the Air Corps, Mr. Peters was appointed sales manager for the International Plastics Corp., and the following year joined the Cofax Corp. in a similar capacity.

R. K. Turner

R. K. Turner, a vice-president of the Union Carbide Corp., New York, N.Y., died suddenly on July 18 at his home in Larchmont, N.Y. He was 59 years old. Mr. Turner attended the Massachusetts Institute of Technology, receiving his B.S. degree in chemical engineering there in 1923, and his M.S. degree in chemical engineering in 1924. That same year, he joined the Union Carbide Chemicals Co. at Clendenin, W. Va. He moved to the Plastics Co. in 1952 as a vice-president, and was appointed president of that division in 1957. He was elected a vice-president of Union Carbide Corp. in June, 1961.

Samuel Adinoff

Samuel Adinoff, retired chief chemist of the St. Clair Rubber Co., Marysville, Mich., died of a heart attack on June 22 while attending a civic affairs meeting in Port Huron, Mich. He was 75 years old. Born in Russia in 1886, Mr. Adinoff came to America in 1903, became a naturalized citizen and graduated from the Polytechnic Institute of Brooklyn in 1917. He served as chief chemist for St. Clair Rubber from 1928 until his retirement in 1956. He was one of the pioneer workers in the development and manufacture of rubber adhesives.

Borden Buys Ohio Firm

Borden Co., New York, N.Y., in an expansion of its chemical business, has acquired the Columbus Coated Fabrics Corp., Columbus, Ohio, in exchange for 525,800 Borden common shares. The value of the transaction would amount to $33,191,125, based on July 27's closing price of 63⅛ for Borden shares on the New York Stock Exchange.

Augustine R. Marusi, vice-president of Borden and president of Borden Chemical Co., and G. Gordon Jelliffe, president of Columbus Coated, in a joint statement, said that the Columbus firm would keep its present management, name, and organization as a division of the Borden Co. Mr. Jelliffe has been named president and principal operation officer of the division.

Offers Polymer Emulsions

Polyvinyl Chemicals, Inc., Peabody, Mass., has developed acid soluble and acid dispersible copolymer emulsions called NeoCryl A-410 and NeoCryl A-400. According to the company, they are actually a new species of polymer emulsions. Both emulsions are not affected by water, soap, or alkaline detergents even after repeated exposure, yet can be quickly and easily removed with mild acidic cleaners. The new cleaners contain functionally active groups that can interact with carboxyls, acid chlorides, acid anhydrides, epoxies, aldehydes, lactones, and sulfhydrils. The materials are expected to find application in adhesives and coatings, as well as in paper, textiles and leathers.

Introduces Stick-Not #762

Crocker, Burbank Papers Inc., Fitchburg, Mass., has developed a new release paper, Stick-Not #762, for use as a carrier for calendered rubber. Highly heat resistant, Stick-Not can be put through heat curing ovens at up to 400°F., according to the company, while its uniformly coated surface imparts a higher finish to the rubber. Strong and tear-resistant, it is said to provide excellent release from rubber products, is easily die-cut, and can be printed on the untreated side.

Fairservice Appointed

H. C. Fairservice has been appointed senior sales advisor for the Adhesive, Resin and Chemical Division of the American-Marietta Co., Seattle, Wash. In his new post, he will act in an advisory capacity for plywood adhesive sales. Mr. Fairservice has served successively as plywood adhesive sales representative, plywood adhesive sales manager, and western sales manager during his fourteen years with the company. He is succeeded in his former post of western sales manager of the division by Robert Freeman, whose responsibilities will include western United States and Canadian adhesive and resin sales to the plywood, paper, composition board, timber laminating, foundry, mineral wool, and electronics industries. Mr. Freeman has been with American-Marietta since 1950. He has served as a plywood adhesive salesman and prior to his current appointment was resin and chemical sales manager.

TB&C Names Roberts

Hamilton H. Roberts, Jr. has joined the Texas Butadiene & Chemical Corp. at the company's laboratories in South Miami, Fla. He will serve as a specialist in industrial baking finishes to augment the firm's applications research activities in the field of surface coatings. Mr. Roberts received his degree in chemistry from Pennsylvania State University. He had previously been associated with the C. J. Osborne Co. and the Interchemical Corp., and was most recently employed by DeSota Chemical Coatings Inc.

Opens Ultra-Pak Building

Packaging Frontiers, Inc., Waltham, Mass., has completed a 10,000-square-foot building which will house its Ultra-Pak packaging machine operations. The new headquarters contains general and sales offices, a customer technical service center for testing and evaluation of customers, products, a production area for developmental machine assembly, and temperature and humidity controlled research and development laboratory.

Milham

McCann

Suffredini

Narmco Appoints Three

Telecomputing Corp., Los Angeles, Calif., has filled three key management positions at its Narmco Materials Division, Costa Mesa, Calif., to accelerate new product development. Leonard P. Suffredini has been appointed to the newly-created post of product development manager. He had formerly been with the Narmco Research and Development Division in San Diego, Calif., where he served as chief of materials application and process development. Forest K. Milham has been named manager of manufacturing. He had previously served as quality control manager. Mr. Milham is suceeded by John H. McCann, Jr., who had previously held a similar position with Wm. Brand Rex Wire & Cable Co.

Develops Metallic Coating

A non-inflammable metallic coating for expanded polystyrene foam has been developed by Adhesive Products Corp., New York, N.Y. Designated Styro-Kote, the material contains no solvent and will not attack expanded styrene or collapse it. According to the manufacturer, it forms a flexible, colored metallic skin which greatly enhances the appearance of molded polystyrene. Styro-Kote can be applied by spray, brush, or roller coater.

U.S. Plywood Earnings

The preliminary financial report for U.S. Plywood Corp. for the fiscal year ended April 30 showed net income at $6,611,700, or $2.55 per common share, compared with $12,872,400, or $5.10 per share, for the previous fiscal period. Sales totaled $256,055,000, against $276,244,000 for the previous fiscal year.

Heyden Develops Resins

Heyden Chemical Division of Heyden Newport Chemical Corp., New York, N.Y., has developed a group of liquid polyamide resins for use as curing agents. Identified as Pentamid 1 and 2, they are blended with epoxy resins used primarily in adhesive, coating, and tooling applications. When cured, according to the company, such blends possess flexibility, exceptional adhesion, high mechanical strengths, resistance to solvents, chemicals and water, and ease of handling.

Litton Buys Simon

Litton Industries, Inc., has acquired Simon Adhesive Products Corp., Long Island City, N.Y., for an undisclosed amount of Litton common stock. Simon Adhesive occupies a 20,000 square foot research and production plant, and has annual sales of almost $2 million.

Walton

Wagoner

Powers

Brobst

Staley Mfg. Promotes Four

A. E. Staley Manufacturing Co., Decatur, Ill., has made four supervisory promotions in its Research and Development Division. Dr. H. M. Walton, formerly with the exploratory group and recently with the polymer group, has been appointed research associate. Dr. John A. Wagoner, previously a senior research chemist, has been named group leader to supervise the physical chemistry group. Dr. R. M. Powers, a research chemist, has been named head of a newly-created laboratory of instrumental analysis. K. M. Brobst, previously a senior research chemist, has been appointed head of the analytical laboratory.

Dr. Walton is a graduate of the University of Frankfort, Germany, and the University of Chicago, and holds doctorate degrees in organic chemistry, law, and philosophy. He joined Staley in 1957 as a senior research chemist. Dr. Wagoner is a graduate of Kansas State College and received his Ph.D degree in organic chemistry. He joined Staley in 1946 as a research chemist.

Dr. Powers is a graduate of Emory University and received his doctorate degree in analytical chemistry. He joined Staley in 1958 as a research chemist in the Chemical Research Department. Mr. Brobst, a graduate of the University of Illinois, joined Staley in 1937 as an analytical chemist.

Mereco 43-21 Introduced

Mereco 43-21, a high temperature epoxy casting and impregnating compound developed by the Mereco Products Division of Metachem Resins Corp., Cranston, R.I., is a low viscosity epoxy system designed to withstand continuous operation for extended periods at temperatures up to 500°F. It exhibits a heat distortion temperature of 300 °F. The system reportedly has a working life of at least four weeks, making it ideal for use in vacuum impregnating operations and laminating applications. In addition, the company reports, Mereco 43-21 displays the typical properties of the epoxy resins, including high-grade electrical properties, complete moisture resistance, excellent adhesion, and stability against chemical attack.

Markets Roof Resurfacer

Stonhard Co., Philadelphia, Penna., has introduced a new roofing compound for repairing, resurfacing, and restoring all kinds of roofing. The new compound, called Stonshield Premium Life Roof Resurfacer, is applied by brush or spray on felt and composition roofs, concrete, gravel, built-up, flat and corrugated metal roofs. The company states that the resurfacer is a combination of fibrous and non-fibrous mineral pigmentation which protects underlying asphalt and roof felts from drying out and causing such defects as alligatoring, tearing, cracking, and loosening or rusting of nails. Stonshield also has a new thixotropic consistency which is said to deposit 16 per cent more solids than ordinary coatings, thus preventing running or sagging.

Barrett Names Four

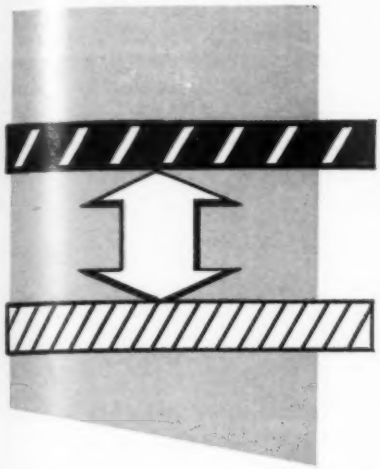
The Barrett Division of Allied Chemical Corp., New York, N.Y., has appointed four new managers in its reorganized Technical Department, as part of a building materials research and development program. Joseph W. Donegan has been named manager of technical service; Richard K. Eberts has been appointed manager of development research; Robert L. Harris becomes manager of laboratory research; and Frank P. Maxwell has been named manager of development engineering.

A graduate of Rutgers University, Mr. Donegan joined Barrett in 1941. He had previously been assistant to the director of research and development. In his new post, he will be responsible for supervising the commercial applications of new products and providing technical service on existing products. Mr. Eberts graduated from Lehigh University in 1943, and joined Allied Chemical's research laboratory at Morristown in 1946 as a research chemist. He formerly was a section head in Barrett's Research and Development Department.

Dr. Harris received a B.S. degree from Bates College in 1947, and his Ph.D. from the University of Wisconsin in 1950, the same year he joined Allied Chemical. Prior to his current appointment, he had served as a section head in the Barrett Research and Development Department. Mr. Maxwell graduated from Alfred University in 1951, and joined Barrett in 1959 in the Engineering Department. He is a specialist in ceramic and gypsum products.

Builds Urea Unit

Sherritt Gordon Mines, Ltd., Fort Saskatchewan, Alberta, Canada, is constructing a urea plant which will have a capacity of about 35,000 tons a year. The unit will produce both prill and crystal forms. Production is scheduled to start in the second half of next year. Ammonia and carbon dioxide, the essential raw materials for the manufacture of urea, will be supplied by the company's present operations at Fort Saskatchewan. All sales will be handled through Harrisons & Crosfield (Canada), Ltd., Toronto.



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names in the news

William C. Teach has joined the U.S. Borax & Chemical Corp., Los Angeles, Calif., as a senior scientist.

Marvin Atlas, formerly associated with Haskins & Sells, certified public accountants, has been named controller of Stein Hall & Co., Inc., New York, N.Y.

Orlando Graziani has been appointed operations engineer for the chemical group of Archer-Daniels-Midland Co., Minneapolis, Minn.

Wesley Copley, technical sales representative for Emerson & Cuming, Inc., has been transferred to the Greater New York City area from the New England area.

William D. Hall, director of research for the Folding Paper Box Association of America, has retired after 10 years with the association.

Len Moyer, previously with the Murphy Lumber Co., has joined the Vancouver Plywood Co., Portland, Ore., as assistant to the general manager.

Clinton J. Allen, Jr. has been named assistant to the president of Wyandotte Chemicals Corp., Wyandotte, Michigan.

Joseph W. Prane, formerly with the National Lead Co., has been appointed technical director of Pecora, Inc., Philadelphia, Penna.

Charles W. Mitchell, vice-president and general manager of the Nyotex Chemicals Division of Stauffer Chemical Co., has retired after 32 years of service.

Norman P. Ottley has been named general purchasing agent for raw materials and fuels for all divisions of the Witco Chemical Co., New York, N.Y.

Dale E. Harnish and *K. Edward Marshall* have joined the staff of the technical service laboratory of Shell Chemical Corp., Union, N.J., as marketing trainees in resins and plastics. *James R. Hallstrom* has joined the Plastics and Resins Department as a chemist.

Hans Stauffer, president of the Stauffer Chemical Co., New York, N.Y., has been elected a trustee of the Bank of New York.

Chester W. Nimitz, Jr., has been elected a vice-president of the Perkin-Elmer Co., Norwalk, Conn., and named general manager of the Instrument Division.

Leonard J. Malin has been appointed plant manager for the Chem Seal Corp. of America, Hawthorne, Calif.

F. Russell Gagnier, previously Southern California sales representative for Nopco Chemical Co., Newark, N.J., has been appointed sales representative in the Pacific Northwest.

Dr. M. Thomas Jones has joined the research staff of the Central Research Department of E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Munro M. Carroll and *Robert W. Bennett* have joined the International Chemical Operations Department of FMC Corp., New York, N.Y.

Carl W. Meyers has been named works manager of the North Tonawanda, N.Y., plant of the Durez Plastics Division of Hooker Chemical Co.

William L. Hogan has been appointed sales representative for the Atlantic Gummed Paper Corp. in the Minnesota, Wisconsin, Nebraska, Kansas, and Iowa areas.

Dr. Allan F. Kingsley

Appointed by Neville

Neville Chemical Co., Pittsburgh, Penna., has appointed Dr. Allan F. Kingsley to its Technical Division, where he will be in charge of analytical activities. Dr. Kingsley formerly was head of the Analytical Research Department of Spencer Kellog & Sons. He attended the West Virginia Institute of Technology where he received a B.S. degree in chemistry, an A.B. degree in zoology, and a Masters degree in organic chemistry. Dr. Kingsley obtained his Ph.D. from Purdue University.

William C. Brunson has been named Midwest regional sales manager for the Antara Chemicals Division of General Aniline & Film Corp., succeeding *G. A. Brost,* who was appointed product manager for intermediates.

Robert J. Cuozzo has been named by American Mineral Spirits Co. as manager of its newly-created north Florida sales district.

Norman C. Riley has been elected to the board of directors of National Starch & Chemicals Co., New York, N.Y., and *Gerald W. Burgoyne* has been elected assistant vice-president.

Dr. Frank M. McMillan, manager of research and development in the Plastics and Resins Division of the Shell Chemical Co., New York, N.Y., has been awarded an honorary Doctor of Science degree from Monmouth College, Monmouth, Ill.

Releasing Paper Offered

A new type of releasing parchment, designed for use in the manufacture of pressure-sensitive tapes, labels, decorative plastic sheeting, bandages, and other especially critical releasing applications, has been introduced by the Paterson Parchment Paper Co., Bristol, Penna. According to the company, Paterson Releasing Parchment 40-195TS offers an extremely smooth, fiber-free surface with excellent releasing qualities on one side, and a surface that accepts printing readily on the other side. The parchment is also recommended for use in the manufacture of medical plasters, caulking materials, or wherever an effective release backing for any tacky or sticky material is desired. Paterson reports that in certain cases, the new material can be used repeatedly.

Cudahy Moves Division

Cudahy Packing Co., Omaha, Nebraska, has moved its Adhesives Division to new offices at 221 North Lasalle St., Chicago 1, Ill. J. N. Schell, manager of the Cudahy By-Products Division, is in charge of the Chicago office. The Division was formerly located at the company's Omaha headquarters.

Swift Earnings Decline

Earnings for Swift & Co. for the six months ended April 29 declined 55 per cent from a year earlier, the company reported. The drop, in the face of higher sales, was attributed to what Swift termed "unfavorable" meat operations. Earnings amounted to $4,123,993, or 69¢ per share in the first half of the fiscal year, against $9,027,038, or $1.54 per share, a year earlier. Sales, however, rose to $1,226,548,000, compared with $1,205,640,000 in the first half of fiscal 1960. The company reported that operating margins in non-food lines were somewhat better than a year ago.

Isochem Names Agent

Isochem Resins Co., Providence, R.I., has named Claude Michael, Inc., Glendale, Calif., as its West Coast representative in the electrical and industrial trades. Robert Michael, vice-president and sales manager of Claude Michael, will be in charge of sales of the Isochem resin lines in California, Oregon, Washington, New Mexico, Arizona, and Nevada. Most materials are now manufacturing on the West Coast stocked at Glendale, and plans for are being formulated.

Monroe Offers Masonry

Monoseal, a clear, liquid, waterproof masonry compounded of silicone resins, and penetrating and aromatic solvents, has been introduced by the Monroe Co., Inc., Cleveland, Ohio. The new masonry is said to produce a more effective method of stopping moisture seepage through masonry walls without altering the appearance. The company states that a single application of the liquid closes every pore in brick, concrete block, stone and other masonry surfaces, preventing dirt and soot accumulation and eliminating efflorescence. In addition, Monroe reports, weather or hot sun will not affect the water repellency of the product, and the liquid will not stop the normal breathing process of the wall construction. Monoseal is applied by wide brush or spray.

3M Develops Epoxies

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has introduced two new room-curing, semi-flexible epoxy resins. Called Scotchcast Nos. 8 and 10, the resins are said to have low exothermic heat rise, and resistance to mechanical and thermal shock stresses.

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Sept. 3-8. American Chemical Society, 140th National Meeting, Chicago, Ill.

Sept. 5-8. American Chemical Society, 11th National Chemical Exposition, International Amphitheatre, Chicago, Ill.

Sept. 5-15. International Packaging Exhibition, London, England.

Sept. 11-13. Technical Association of the Pulp & Paper Industry, 11th Corrugated Containers Conference, St. Francis Hotel, San Francisco, Calif.

Sept. 11-15. Instrument Society of America, 16th Annual Instrument-Automation Conference and Exhibition, Biltmore Hotel and Memorial Sports Arena, Los Angeles, Calif.

Sept. 13-15. Armed Forces Systems Command, Aeronautical Systems Division, Symposium on Materials in the Space Age, Phoenix, Ariz.

Sept. 13-15. Armed Forces Chemical Association, 16th Annual Meeting, Statler Hotel, Washington, D.C.

Sept. 18-19. Chemical Market Research Association, Lake George Sagamore, Bolton Landing, N.Y.

Sept. 18-22. Instrument-Automation Conference & Exhibit, New York, N.Y.

Sept. 22-Oct 1. International Plastics Fair, Copenhagen, Denmark.

Sept. 24-27. American Institute of Chemical Engineers, 45th National Meeting, Lake Placid Club, Lake Placid, N.Y.

Sept. 25-27. National Flexible Packaging Association, Fall Meeting, Waldorf-Astoria Hotel, New York, N. Y.

Sept. 25-28. Industrial Building Exposition & Congress, New York Coliseum, New York, N.Y.

Sept. 27-28. Symposium on Modern Structual Adhesives Technology, Picatinny Arsenal, Dover, N. J.

Sept. 28-29. Rubber & Plastic Adhesive & Sealant Manufacturers Council, Fall Meeting, Cherry Hill, Haddonfield, N. J.

Sept. 28-30. American Society for Quality Control, Chemical Division, 5th Annual Chemical Conference, Daniel Boone Hotel, Charleston, W. Va.

Sept. 24-27. American Institute of Chemical Engineers, 45th National Meeting, Lake Placid Club, Lake Placid, N.Y.

Oct. 4. National Fibre Can & Tube Association, Drake Hotel, Chicago, Ill.

Oct. 4-6. ASME Process Industries Conference, Shamrock Hilton Hotel, Houston, Texas.

Oct. 7-10. First Annual Western Building Industries Exposition, Great Western Exhibit Center, Los Angeles, Calif.

Oct. 9-11. Technical Association of the Pulp & Paper Industry, 16th Plastics Conference, French Lick Sheraton Hotel, French Lick, Ind.

Oct. 10-12. American Standards Association, 12th National Conference, Rice Hotel, Houston, Texas.

Portrait of

SIDNEY LITVAK

Sidney Litvak is a project engineer at the Aeronautical systems Division Wright-Patterson Air Force Base, Ohio, and as such is responsible for both contractural and internal research programs pertaining to heat-resistant laminating resins and structural adhesives. In addition, he is involved in research programs instituted to advance the "state-of-the-art" in filament-wound composites. The emphasis here will be on increased high-strength to density ratio of the composite structures by use of new and improved component materials, the resin and filament reinforcement.

A few of the problems Mr. Litvak has been concerned with include improved polymeric resin systems for reinforced plastic, formulating structural adhesives for high-temperature bonding for Aerospace vehicles, and investigation of such phenomena as the mechanical property behavior of materials applicable to flight environments.

Mr. Litvak received his B.S. in chemistry from Western Reserve University in 1953 and has taken specialized courses in synthetic and epoxy resins at U. C. L. A. He was previously employed in the Structural Materials Division, Aerojet-General Corp., as a research engineer responsible for the evaluation of structural adhesives and plastics for rocket-motor cases.

Hexcel Earnings Up

Hexcel Products, Inc., Berkeley, Calif., reports that its net earnings for the second quarter ended June 30 almost tripled earnings posted in the first quarter. Earnings in the second quarter of 1961 were $46,651, equal to 18¢ per share, compared with the first quarter figure of $16,751. Sales for the second quarter were $1,566,924, slightly up from the first quarter sales of $1,533,113.

Consolidated sales for the first six months of 1961 were $3.100,037, compared with $3,194,834 in the same period a year ago. Earnings for the first half of 1961 amounted to $64,402, equal to 25¢ per share, compared with the year-ago figure of $89,907, or 35¢ per share.

William S. Powell, Hexcel president, reports that the company is increasing its efforts to locate and exploit commercial applications for its products. He emphasized that this in no way implies that Hexcel is diminishing its emphasis on military and space age applications, but the diversification into commercial markets should permit the company to more fully exploit its potentialities.

Muir Heads Label Group

W. Wallace Muir, president of the Grand Rapids Label Co., Grand Rapids, Mich., has been elected president of the Roll Label Manufacturers Association. Other newly elected officers of the group are: *Vice-President,* Arthur D. Berliss, Jr. (Allen Hollander); *Treasurer,* J. A. Larson (A. M. Steigerwald); *Executive director and general counsel,* John A. Bresnahan. Duane Hillmer (Paramount Paper Products) and M. J. Mateo, Jr. (Fairbairn) were elected to fill vacancies on the board of directors.

Introduces Poroseal

Poroseal, a surface-sealer especially created for the preparation of porous surfaces on which self-adhesive materials are to be applied, is being distributed by Synthetics Fabrics, Inc., Springfield, Mass. The non-flammable sealer was formulated for do-it-yourself customers who use self-adhesive materials. It is brushed on like paint and dries in approximately two hours.

SPI Holds Election

The Society of the Plastics Industry, Inc., has elected Walter F. Oelman, treasurer of Standard Molding Corp., Dayton, Ohio, as its new president. Other newly-elected officers are: *Vice-president,* T. T. Miller (W. R. Grace); and *Secretary-treasurer,* Harry M. Jenkins (General American Transportation). The society also elected Russell C. Weigel, assistant general manager of the Polychemicals Department of DuPont, as chairman of the SPI board.

Mobay Building Unit

Plans to construct additional multi-purpose plant facilities for the manufacture of a broad range of organic isocyanates were announced by Mobay Chemical Co., Pittsburgh, Penna. The new addition, which will have a production capacity of several hundred tons per month, will be located adjacent to Mobay's tolylene diisocyanate plant at New Martinsville, West Va. Completion of the new facility is scheduled for early 1962.

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Acquires Wood Elastic

The Kendall Co., Boston, Mass., has purchased all assets of the J. W. Wood Elastic Web Co., Stoughton, Mass. The amount involved was not disclosed. Wood Elastic operates plants in Stoughton and South Easton, Mass., and in Shelby, N.C. The company will continue to operate at these locations as a Kendall subsidiary. No changes in personnel are planned. In 1960, Wood Elastic showed a profit of $5,102,460, or $2.44 a share. Sales totaled $111,617,086.

Introduces Epoxy Pellets

An epoxy in pellet form has been introduced by Epoxy Products, Irvington, N.J. The company states that the pellets will bond most hard-to-bond materials. They are designed for good chemical and solvent resistance, low moisture permeability, and good electrical characteristics. Curing temperatures can be varied from 85°C. for bonding heat-sensitive components, to 250°C. for a fast-cure bond. The bonding material can be made either flexible or of the pellet.

Borden Has Record Half

Sales and earnings of the Borden Co. for both the quarter and half-year ended June 30 were at all-time highs, with a 2.9 per cent increase in net income in the first half and a 2.7 per cent increase in first half sales. Net income for the first six months of 1961 was $13,781,302, equal to $1.37 per share, compared with the 1960 figure of $13,394,158, or $1.35 per share. First-half sales totaled $484,075,399, compared with $471,487,360 in the comparable period last year.

Second quarter earnings were $8,180,767, equal to 81¢ per share, up 2.9 per cent from the year ago figure of $7,948,540, or 80¢ per share. Sales for the second quarter of 1961 totaled $245,450,543, compared with $241,474,365 in the 1960 second quarter, a gain of 1.6 per cent.

According to Harold W. Comfort, president of Borden, earnings were strengthened by new products, improved returns from foreign subsidiaries, and a recent pickup in chemical activities, factors which offset the narrowed margins of other company operations. He added that the earnings trend should continue as general business conditions improve.

Mystik Names Five

Mystik Adhesive Products, Inc., Chicago, Ill., has appointed five men to new management posts. Milton R. Stohl has joined the firm as vice-president and director of sales and marketing, and Albert H. Zeigler has been named vice-president of technical and manufacturing operations. In other appointments, C. P. Scott becomes technical service manager, Frances E. Weeg is manager of manufacturing and Frederick C. Beyer has been named manager of quality control.

Building Monomer Unit

National Starch & Chemical Corp., New York, N.Y., plans to build a $4 million vinyl acetate monomer plant with an annual capacity of 45 million pounds. One of two sites currently under study in Texas will be selected for the location of the facility, which is expected to be in operation by the Fall of 1962.

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By MELVIN NORD

Bonding Foldable Board

U. S. Patent 2,984,598, issued May 16, 1961 to Kenneth C. Gobalet and assigned to Baljak Corporation, relates to adhesively bonding overlapping areas of foldable board, such as paperboard, box board, or other foldable sheet material, during the shaping of a box blank into hollow box form or during the closing and sealing of boxes after filling.

According to the present invention, an instant or contact-type bond is formed which after an initial and brief application of pressure requires no continued application of pressure, thus eliminating the need for an extended pressure section in the gluing or sealing machine. The bond produced is moisture free for all practical purposes and remains secure and reliable at low refrigerating temperatures of the order of 0°F. as well as at high daytime temperatures of the order of 100°F.

The method and apparatus are shown in Figures 1 and 2. An aqueous emulsion of a thermoplastic adhesive is first applied to the areas to be adhered. This is heated to a temperature above the boiling point of water to a point sufficient to melt the adhesive component, thereby converting the adhesive component from its divided emulsion state of low tackiness into a contact-type adhesive of high tackiness. Then the adhesive coated areas are pressed together, forming an instantaneous contact-type bond.

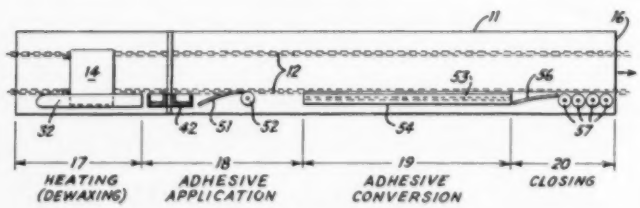

Figure 1

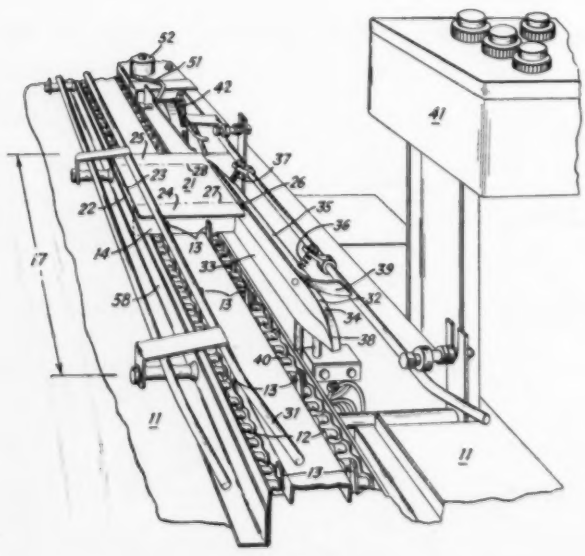

Figure 2

Label Tape to Rubber

U.S. Patent 2,984,496, issued May 16, 1961 to Victor R. Franer and assigned to Minnesota Mining and Manufacturing Company, discloses a method of providing the surface of a vulcanizable rubber article with inked indicia substantially permanent in the face of abrasive and weathering action after vulcanization with the rubber article.

The method consists of marking the exposed surface of a thin transparent ink-receptive tacky vulcanizable rubbery film with vulcanizable ink. The film must be supported by a flexible releasable carrier web and adhered to it by means of a thin transparent vulcanizable protective butadiene-styrene layer. Next, the exposed inked surface of the rubbery film is layed against the vulcanizable rubber article so that the two are bonded together and the unit is subjected to vulcanizing conditions. Finally, the carrier web is removed.

Coated Abrasive Composition

U.S. Patent 2,983,593, issued May 9, 1961 to Bruce W. Duke and assigned to Norton Company, discloses a coated abrasive consisting of a flexible backing member and abrasive grains bonded to one side of the backing by a maker and size coat of adhesive.

At least one coat is the heat-cured condensation product of a composition consisting initially of a urea-formaldehyde pre-condensate (or similar substance), and a latent curing system consisting of certain amino compounds and an ammonium salt.

Teflon to Prepared Surfaces

U.S. Patent 2,984,599, issued May 16, 1961 to George D. Edwards and Thomas K. Rice, assigned to Secretary of the Navy, provides a method of bonding Teflon sheets to another material to produce a stress-free structure.

The surface of the material is pre-coated with a composition containing Teflon. The coating is dried at 90°C., and fused at 380°C. The surface of a sheet of Teflon is then placed in direct contact with the coating, and the sheet is fused to the coating. The coating and sheet are then pressed together while annealing them to well below the fusion temperature of Teflon.

Polyethylene Bond

U. S. Patent 2,970,078, issued January 31, 1961 to Alvin R. Nielsen and assigned to Plax Corp., provides a method of bonding a polyethylene surface to another surface.

A coating of a saturated aqueous solution of chromium trioxide is applied to the surfaces. The surfaces are pressed together while wet, and the coating is then dried.

Tacky Sealing Members

U.S. Patent 2,981,651, issued April 25, 1961 to Robert W. Arnold and assigned to American-Marietta Company, relates to a method of bonding tacky sealing members such as washers to metal fastener elements.

As shown in Figure 3, a nut-washer is designated by the reference character 5. It comprises an assembly of a nut (7) and a cupped metal washer (9). The metal washer is held in assembly with the nut by a bent-out flanged portion (10) of the nut. A sealing member (1) of this invention (having the powdered resin (3) dusted on its entire surface area is bonded to the metal washer by heating the nut-washer

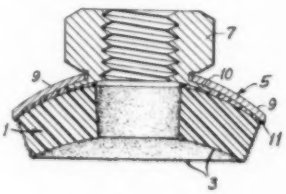

Figure 3

(including the metal washer) to a temperature of 300°F. to 400°F., then pressing the sealing member against the face of the washer. In the case, for example, of the use of the two-stage resin above mentioned, the resin on the face of the sealing member contacting the heated washer first melts and then sets or cures into an infusible mass which is strongly adherent to the sealing member and the washer. The layer of the infusible mass formed upon curing of the resin is indicated at 11.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Adhesive for metal surfaces	Deutsche Gold-und Silber-Scheideanstalt vormals Roessler	2,981,650	4/25/61
Testing gummed tape	Minnesota Mining & Mfg. Co.	2,982,129	5/ 2/61
Wallpaper trimming and pasting machine	William C. Renne	2,982,490	5/ 2/61
Automatic pasting machine for paper sheets	Charles R. Patterson	2,982,979	5/ 9/61
Cement handling apparatus	United Shoe Machinery Corp.	2,983,270	5/ 9/61
Bonding panels to base surfaces	National Plastic Products Company	2,983,305	5/ 9/61
Transfer device for adhering shoulder labels to bottles	George J. Meyer Mfg. Co.	2,983,398	5/ 9/61
Method of making honeycomb	Hexcel Products Inc.	2,983,640	5/ 9/61
Foil adhesive system	American-Marietta Co.	2,983,641	5/ 9/61
Polyurethane adhesive	E. I. du Pont de Nemours & Co.	2,983,693	5/ 9/61
Bonding of elastomers	Phillips Petroleum Co.	2,984,281	5/16/61
Tape applying apparatus	American Can Co.	2,984,289	5/16/61
Tape dispenser	International Graphics, Inc.	2,984,369	5/16/61

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D.C., for 25 cents each. Do not send stamps.

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Push-Button Applicator

Instantaneous and exact regulation of adhesive flow is said to be obtained with a new push-button control on the brush barrel of an adhesive applicator. The applicator

feeds solvent and water-based adhesives through a flexible hose directly into the brush under ordinary factory air pressure. It includes a pressure tank which dispenses adhesives of average viscosity at 20 pounds pressure, and has an air regulator which allows accurate setting at any desired pressure. Tanks of two and five gallon capacity are available with the adhesive applicator, designated Model B. Three outlets on the tank permit installation of as many as three hoses enabling up to three operators to work from one unit. *B B Chemical Co.* **E-346**

Label Numbering Device

A numbering device for label printing machines, this unit will print consecutive numbers or duplicate from two to eight times before advancing automatically, or repeat a number. It comes with up to seven digit wheels in a choice of Roman or Gothic type face with a wide range of sizes. *Weber Marking Systems.* **E-347**

Automatic Scale

The Dynabatch Model 816 automatic weighing system is specifically designed to handle liquids or slurrys with a wide range of viscosities. It is used for completely automatic batching of one or more liquids, and with automatic weigh-in and weigh-out, can work against a heel of material. The unit is available in a variety of capacities up to 10,000 pounds with accuracies of 1/10 of 1 per cent of full scale or better. In use, the system draws any number of raw materials, weighs them to pre-set amounts, and sends the precise batch to mixers. The Dynabatch control system, the "brain" of the scale, features automatic digital programming of weight. Programming can be by digital switches, punch card or tape. Mechanically, the scale features the exclusive Dynametrics cross-flexure pivot for maximum system accuracy, repeatability, and linearity. *Dynametrics Corp.* **E-348**

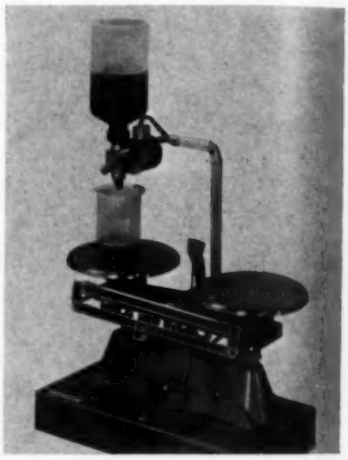
Leveling Test Blade

The New York Leveling Test Blade, designed for use in quality control programs and laboratory research, is said to allow better production analysis through accurate measurement of leveling. According to the manufacturer, this rapid draw-out test method correlates well with brushout ratings, eliminates wetting of the substance as a variable, provides clearly defined numerical ratings, and is completely reproducible from one operator to another. It is not applicable to unpigmented products. *Precision Gage & Tool Co.* **E-349**

FOR MORE INFORMATION on these new products use the Readers' Service Coupon on page 56 of this issue.

Automatic Weighing Scale

An automatic weighing scale, the Autogram provides a rapid and accurate method of weighing and dispensing batches of one or a multitude of liquids. In operation, it is only necessary to set the scale for the required weight, press a control switch, and an electrically controlled valve dispenses the liquid and shuts off when the proper amount has been dispensed. The scale is equipped with a new Series 515 air operated, solenoid controlled valve said to augment the usefulness of the



Autogram scale by extending its applications to liquids having viscosities well over 100,000 cps. A wide range of body and seat materials is available for the valve itself. The manufacturer states that by proper choice of the materials many so-called difficult liquids can be handled such as acids, bases, ketones, amines, as well as liquids containing abrasive fillers. By using a small amount of air pressure, from 3 to 15 psi, in the liquid reservoir, adequate flow rates can be obtained for the more viscous fluids. *Delsen Corp.* **E-350**

Water Bath Shaker

The Gyrotory water bath shaker is a continuous-duty laboratory apparatus for metabolic incubation and other experimentation involving agitation at controlled temperatures. Where bench-top space is not available, this mobile instrument can be efficiently operated beneath desks and laboratory benches by using a space-saving dolly as an accessory. A wide range of agitation and tem-

perature can be accurately controlled and reproduced at any time. The water bath heats rapidly to pre-set temperatures from ambient to 100 °C., with a temperature uniformity of ±½°C. Agitation speeds are adjusted and maintained mechanically between 85 and 285 rpm. They are unaffected by load changes or by line voltage fluctuations. A speed range of 140 to 400 rpm may also be had. Seventeen interchangeable shaking platforms accommodate various numbers, kinds, and sizes of glassware, including flasks, beakers, and test tubes. *New Brunswick Scientific Co.* **E-351**

Wet Film Applicator

The 2-path wet film applicator has a path on each side so that film thicknesses of 1 and 2 mils or 3 and 5 mils may be laid precisely. The applicator has paths calibrated in

actual depths for maximum accuracy, with path depths and parallelism held within .0001-inch. The working surfaces of the applicator have been hardened and ground, and given a black oxide finish to retard rust and discoloration. According to the manufacturer, the applicator can be used in the adhesive, plastics, and coatings industries for a variety of tests, and is used in conjunction with hiding power and penetration charts. *Precision Gage & Tool Co.* **E-352**

Automatic Labeling Machine

Pressure-sensitive paper and fabric labels can be die cut from roll stock at speeds up to 100 per minute with the Model 126 labeling machine. The unit automatically feeds the roll stock and makes a high quality imprint of company name, address, trademark, or other fixed data. In the same operation, variable copy such as quantity, part name and number, order number, date code and inspector number are printed by an inexpensive metal address plate. In the same operation, a guillotine attachment cuts through just the pressure-sensitive label stock, leaving the backing paper intact. The labels can be simultaneously rewound or cut off and stacked, to be peeled from the backing when needed. The Model 126 may be equipped with a predetermining counter which automatically stops the machine after a pre-set number of labels has been made. Four different models of the 126 machine are available, providing one- or two-color imprints. *Marker Machine Co.* **E-353**

Bottle Labeler

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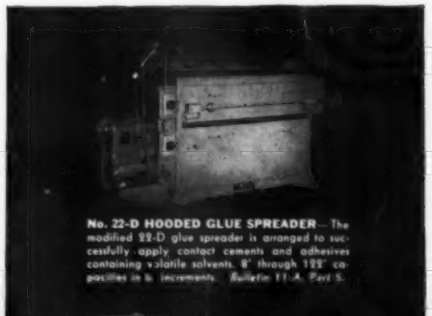

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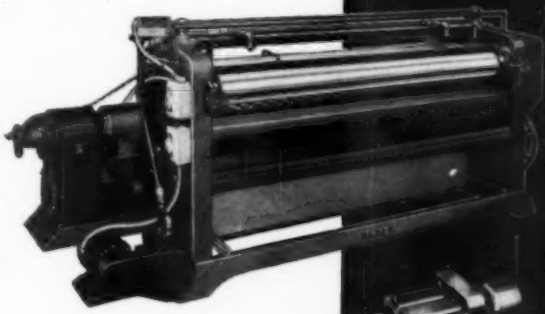
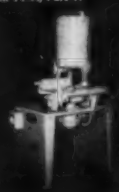


No. 22-D GLUE SPREADER — For resins, caseins, polyvinyls, protein and similar adhesives; 39 sizes in four models; 8' through 128" capacities in 8" increments. Proven the finest spreader available for the purpose. *Bulletin 11-A, Part 4.*

No. 2-B' BENCH-TYPE GLUE SPREADER — For light edge gluing and similar operations. Roll is 4' diam. x 8" long. *Bulletin 11-A, Part 1.*

No. 567 GLUE SPREADER — Floor type, power-driven, hand feed roll glue spreader for edge gluing and similar operations. 12", 18" and 24" roll widths with 8½" diam. rolls. *Bulletin 11-A, Part 2.*



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book reviews

The Chemical Formulary. Vol. XI. ***Editor-in-Chief, H. Bennett. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N.Y. 5¾ x 8¾ in. 416 pp. $8.00.***

This book, subtitled "A collection of valuable, timely, practical, commerial formulae and recipes for making thousands of products in many fields in industry," is the eleventh and latest in an on-going series. Like its predecessors, it contains hundreds of new formulas on adhesives, ceramics and glass, cosmetics and drugs, emulsions, farm and garden products, food products, ink, leather, lubricants, materials of construction, metals, paints, varnishes and lacquer, paper, photography, polishes, explosives, rubber, plastics, waxes, soaps, detergents, and textiles.

It does not duplicate any of the formulas included in previous volumes, but lists a wide array of salable, practical products from nearly every branch of the chemical industry.

Among the formulas included are specific ones for tile, vinyl copolymers-to-glass, and shoe adhesives; urethane caulking compounds, a glass fiber binder, a polystyrene adhesive, and numerous others in this specific field. Other sections contain information for making low density urethane foam, PVC garden hose, a rubber surface preservative, molding compounds for jigs, a V-belt base compound, rubber-covered roll compounds, and others. As is typical in the series, this volume contains a list of sources of chemicals and supplies.

Infrared Spectroscopy; Its Use as an Analytical Tool in the Field of Paints and Coatings. ***Published by Chicago Society for Paint Technology, 1350 S. Kostner Ave., Chicago 23, Ill. 5¾ x 8¾ in. Softbound; 160 pp. $2.75.***

As a laboratory manual this volume and an accompanying library of spectra have been prepared for the chemist or technician in the paint and coatings industry who is directly concerned with the analysis of coatings and similar materials. The assumption made by the Infrared Spectroscopy Committee of the Society which prepared the booklet is that infrared methods of analysis offer advantages which should be clearly delineated.

Among these, the introduction to the manual points out, are (1) the availability of a low cost, easy-to-operate spectrophotometer, and (2) the fact that personnel necessary to operate this equipment and evaluate the results are already present in most coating laboratories. This manual is designed consequently to rapidly lead the novice into a practical working knowledge of infrared analysis.

Following an eight page section on theory, the manual presents chapters on, in order: Preparation of Samples for Analysis; Cleaning, Grinding, Polishing and Care of Windows and Cells; Qualitative Analysis; Quantitative Analysis; Research Applications; and an Appendix, which contains a lengthy bibliography, instructions for preparations of samples for the library of spectra, the index of spectra included in the book, and the reference library of spectra.

The library itself contains 195 spectra, grouped by function of the material: binders, pigments, and solvents.

Progress in Dielectrics. Vol. II. ***Edited by J. B. Birks and J. H. Schulman. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. 6¼ x 9¾ in. 225 pp. $9.50.***

This is the second in a planned annual series of volumes surveying the present state of knowledge in selected specific areas within the scope of the main subject. This volume is typical of the series in that it contains a number of papers, each presented by an acknowledged expert in his particular field, regardless of country.

The six papers presented here cover (1) Theory of Polarization and Absorption in Dielectrics: An Introductory Survey, by G. Wyllie, (2) Dielectric Properties of Polymeric Systems, by A. J. Curtis, (3) Irradiated Polymers, by R. M. Black and A. Charlesby, (4) The Dielectric Properties of Glass, by P. M. Sutton, (5) High-Permittivity Ceramics for Capacitors, by K. W. Plessner and R. West, and (6) Artificial Dielectrics, by J. Brown.

As can be perceived from this listing, the scope of the book crosses substantive fields, but has as a main theme dielectric properties in weak electric fields. The second aim of the volume (and the series), apart from that mentioned above, is to provide a meeting point for all who encounter problems of dielectrics in their work, including beside physicists and electrical engineers, rubber and plastics chemists and technicians, and others doing work in the whole range of the newer materials.

The initial surveying chapter discusses energy in dielectrics, linear behavior, mechanical models, static models, general theory, the crystalline state, mechanisms of dielectric loss, and some of the recent developments.

The second paper, on properties of polymeric systems, is largely restricted to a discussion of dielectric properties as they related to molecular and intermolecular structures. It specifically subordinates reports of work directed toward finding of suitable materials for manufacture of insulation, for instance, or reports of measurements on special materials of unknown origin, those insufficiently characterizable, or ones of a composite nature, such as laminates.

"Progress in Dielectrics, Vol II." will be of value to the researcher specifically concerned with the subject, but less so to the technician searching for the solution to a particular problem.

Trade Literature

ORGANIC CHEMICALS AND POLYMERS. This 8-page bulletin, entitled "AIRCO—Organic Chemicals and Colton Polymers," offers information on a large group of products, ranging from calcium carbide and pipeline acetylene to organic compounds and special-purpose resins. Also available are two abbreviated versions of the comprehensive list. A 6-page bulletin entitled "Colton Polymers" lists the physical properties and applications of Vinol polyvinyl alcohols, Flexbond copolymers, Vinac polyvinyl acetates, Felxac polyvinyl acetates, and Aircoflex dibutyl phthalate. "Airco Organic Chemicals" is a 4-page bulletin covering Airco vinyl monomers, acetylene alcohols and glycols, alkyl acetylenes, and Surfynol surface active agents. *Air Reduction Chemical & Carbide Co.* ***L-403***

HEXACHLOROCYCLOPENTADIENE. Typical chemical reactions of C-56, the registered trademark for hexachlorocyclopentadiene, are described in this technical bulletin. Among end products derived from C-56 are pesticides, nonflammable resins, and chemical intermediates having potential application as fungicides, germicides, pharmaceuticals, dyes and resins for paints. In addition to the typical reaction products illustrated by their structural formulas, the publication covers physical data on C-56 toxicity, and recommendations for handling the product. *Hooker Chemical Corp.* ***L-404***

CONTRACT RESEARCH FOR INDUSTRY. This 4-page brochure, entitled "The Administrative Controls of Contract Research for Industry," is a descriptive statement aimed at representatives of industry concerned with research and development. The statement describes the balance of administrative controls between the sponsor of a project and the re-

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- **Adhesive Bonding of Reinforced Plastics—H. A. Perry. $8.75.** Survey of the design and assembly of structures and products, particularly glass-fiber-reinforced plastic products, by means of adhesives. Gives data on equipment and methods used to produce adhesive bonded joints. ☐

- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice —A. X. Schmidt and C. A. Marlies. $14.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives, their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research —G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Epoxy Resins—Irving Skeist. $5.50.** A chapter on adhesives is included in this complete study of the entire field of epoxy resins. The author gives formulations, trade names, methods of manufacture and applications. ☐

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search institute engaged, under contract, to conduct the study. As pointed out in the statement, the sponsor retains basic control over the objective, scope, costs, and timing of research, but is relieved of technological administration. Each of these aspects of administrative controls is discussed briefly. *Battelle Memorial Institute.* **L-405**

PROTECTIVE COATING FORMULATIONS. A number of quick acting, safe and easy to use protective coating stripping formulation suggestions are presented in Bulletin 8-16. The coatings include phenolics, epoxies, urea-and melamine-formaldehyde, and varnishes, as well as coatings based on drying oils. The formulations provide such features as increased efficiency with a reduction of caustic, shortening of stripping time, and special viscosity properties and stability at both room and elevated temperatures. *Armour Industrial Chemical Co.* **L-406**

FILM LAMINATING SYSTEM. This spiral-bound brochure contains complete specifications on a continuous rotary film lamination system for plywood, metal, or semi-rigid substrates. The laminating unit is thoroughly described, and the brochure includes a list of process data sheets available indicating the various continuous process areas for the unit. *C. A. Litzler Co., Inc.* **L-407**

ROTATING VISCOMETER. The Haake Rotovisco rotating viscometer is the subject of this 12-page, illustrated bulletin. The literature includes technical data on the Rotovisco as well as its applications. With adhesives, the unit will reveal the effectiveness on application, comparison of yield, influence of evaporation on flow characteristics, and swelling, dissolving, setting and aging processes of adhesives. Other items covered include principle of measurements, components, temperature control, and measuring systems, as well as performance tables. *Brinkmann Instruments, Inc.* **L-408**

ACRYLIC AND VINYL ACETATE EMULSIONS. These new product bulletins describe the manufacturer's latest acrylic terpolymer and vinyl acetate copolymer emulsions designed for use by the adhesives industry. According to the bulletins, the emulsions produce films of exceptional flexibility which also exhibit high mechanical and chemical stability. In addition, they can be further compounded with a wide variety of plasticizers. *Stein Hall & Co.* **L-409**

FOR MORE INFORMATION on the literature items described here, use the Readers' Service Coupon on page 56.

POLYAMIDE RESINS. The blending of Versamid polyamide resins with epoxy resins to produce superior adhesives and sealants is discussed in technical bulletin 11-F-2. Three polyamide resins, Versamid 140, 125, and 115, are described in this 24-page catalog. In addition to giving data on the physical and chemical properties of the Versamid resins, the booklet contains data and tables on resin selection, resin ratio, blending, pot life and exotherm surface pre-treatment, curing, additives, and fillers. Other subjects covered are adhesion to various surfaces; suggested starting formulations; sealants, putties, and patching compounds; handling; availability; and toxicity. *General Mills.* **L-410**

TEXTURED COATINGS. Bulletin No. T-161 is a 4-page, 4-color brochure describing the uses of Bostik textured coatings on buildings. Covered are architectural specifications such as general conditions, extent of work, materials and workmanship, preparation, application procedure, coverage, and color selection. *B B Chemical Co.* **L-411**

AIR OPERATED C CLAMPS. Bulletin 91029 is a 4-page brochure containing engineering design drawings and tabulated data for two series of air operated C clamps. Also covered is a description of optional features, ordering data, and photographs of 2-, 3-, and 4-way valves. *Airmatic Valve, Inc.* **L-412**

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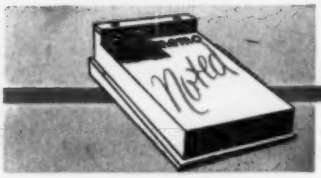

in passing

Alcoholism in Industry

There are an estimated 2,000,000 alcoholics regularly employed by business and industry, according to a recent report from the National Council on Alcoholism. Most of them are between 35 and 50, and have been on the payroll for over 10 years. Estimates are that they cost their employers approximately one billion dollars annually.

Why do they drink? The NCA thinks it's probably a combination of things—social pressures, emotional problems, and perhaps even a physical make-up that renders them particularly susceptible to alcohol. Whatever it is, it makes the alcoholic absent from work 22 days more per year than the average employee. In addition, he is apt to be off work on Mondays and Fridays especially. Among high-status employees, half-days are frequent—mornings are spent working, and afternoons drinking.

Strangely enough, reports NCA, the alcoholic is often a Dapper Dan. He may sport sharp clothing and shiny shoes under the misguided notion that he is keeping up appearances.

The National Council on Alcoholism, 2 East 103rd Street, New York City, is a non-profit, voluntary organization composed of physicians, scientists, and interested members of the public. Both small and large companies may turn to it for information on setting up programs to detect and help an alcoholic, for establishing a policy toward alcoholism, and for help in sponsoring educational programs about alcoholism.

Before leaving the topic, we would like to point out to amateur detectives and psychologists that sharp clothes, shiny shoes and an occasional absence on a Monday or Friday are not in themselves significant or insidious.

Gung Ho!

The U.S. Air Force has hired a group of professors to teach a computer to play ancient Chinese games. No, it's not boondoggle, but part of an experiment with apparently important implications for defense and business.

Details are explained in a report entitled "General Switching Theory," which may be purchased through the U.S. Department of Commerce, Office of Technical Services, Washington 25, D.C. The report is one of thousands of government research publications made available for use in industry and science.

Tomorrow's Scientists

The Thomas Alva Edison Foundation recently published a report on an interesting New Jersey experiment in cooperation between educational institutions and local industry. Entitled "School-Industry Cooperation for Better Science Education in New Jersey" the report describes a unique project designed to keep science teachers and students abreast of up-to-date techniques being used in industry today.

With the cooperation of companies such as New Jersey Bell Telephone, Esso Research and Engineering, Ciba Pharmaceutical, Johns-Manville and others, a series of forums, traveling lecture-demonstrations and visits to research laboratories was set up to show science teachers and budding scientists just how scientific techniques are applied in the modern industrial laboratory.

The project has reportedly met with such success that it has been incorporated as a permanent part of the program of the New Jersey State Department of Education.

Buzz Buzz Buzz

We hesitate to think that male bees in England are effete, but what else are we to make of this item from the tight little island? It seems that to improve the breed of bees, the English have developed a steel tube with an outside diameter of 0.00073 inches — about one-fourth of a human hair—for purposes of artificial insemination. The inside diameter of the tube is 0.0001 inches.

By the Sea, By the Sea

Frankly, we'll be sorry to miss this one, but we didn't find out about it until our vacation plans were already set. The annual convention of the International Concatenated Order of Hoo-Hoo is being held this year at the Hotel Americana, Miami Beach, Fla., September 16-19.

Adhesives Head the List

The Building Research Institute recently surveyed its members as to topics of greatest interest for future BRI Conferences. The subject receiving the highest number of votes was "Adhesives and Sealants in Building."